

**WATER RESOURCES DEVELOPMENT PROJECT**

**OPERATION AND MAINTENANCE**

**MANUAL**

**FOR**

**LOCAL PROTECTION PROJECT**

**FORT KENT, MAINE**

**ST. JOHN RIVER**



**DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.**

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OPERATION AND MAINTENANCE MANUAL  
FOR  
FLOOD PROTECTIVE WORKS  
SAINT JOHN RIVER  
AT  
FORT KENT, MAINE

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FOREWORD

The successful functioning of the Flood Protection Works is not assured solely by construction of a system of dikes, floodwalls, flood-gates, sluice gate structures, and other appurtenant structures. If the system is to perform the functions for which it was designed, it must be carefully maintained during periods of normal river stages and properly operated during flood periods.

The need for proper maintenance cannot be too highly stressed in view of the fact that large damages may be incurred through operating failure of a critical element in flood time, caused by deterioration or damage that would have been eliminated by proper maintenance.

Necessary maintenance and proper operation require that responsible local persons have a thorough understanding of the functions of the various units of the system and the recommended methods of maintaining the system and operating it during flood emergencies. It is the purpose of this manual to provide complete information so that all parties may fully understand their responsibilities in maintaining and operating the flood protection system in accordance with the regulations prescribed by the Secretary of the Army as amplified by this manual.

The general flood control Regulations for Maintenance and Operation of Flood Control Works quoted herein were approved by the Acting Secretary of War on 9 August 1944. Upon establishment of the Department of Defense, the improvement of rivers and harbors and other waterways for flood control and other purposes, formerly under the jurisdiction of the Secretary of War, became the responsibility of the Secretary of the Army. Reference therein to the Secretary of War and War Department shall be construed to mean, respectively, the Secretary of the Army and the Department of the Army. Where reference is made to the District Engineer in the Regulations included in this manual, it shall be construed to mean the Division Engineer, New England Division, Corps of Engineers.



## A. GENERAL

1. PURPOSE OF THIS MANUAL. The purpose of this Manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on 9 August 1944, and published in this Manual as Appendix "A".

The regulations are intended to cover all local protection projects constructed by the Department of the Army throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this Manual for maintenance and operation of the Fort Kent project are intended to supplement the Regulations to insure the maximum protection against floods for which the project was designed. Failure to maintain and operate the project as required by the Regulations and as detailed herein can result in severe property losses, loss of life, and irreparable loss of confidence in the flood protection system by citizens who have invested their funds on the basis of the protection afforded by the flood control works.

Included in the authorization of the project are conditions specified by the Secretary of War to be met by local interests. One of these conditions is the Operation and Maintenance of the project after its completion. Under Assurances, dated 26 January 1976, furnished to the Government by the town of Fort Kent, the town of Fort Kent has agreed to meet these conditions, and in particular, the operation and maintenance of the project after its completion. A copy of the above assurances is included in Appendix "D" of this Manual.

2. PROJECT AUTHORIZATION. The Fort Kent Local Protection project was approved by the Chief of Engineers on 3 September 1975 under authority granted by Section 205 of the 1948 Flood Control Act, as amended by Section 61 of the Water Resources Development Act of 1974, Public Law 93-251, approved 7 March 1974 (33 USCA 701s)

3. PROJECT LOCATION. The Fort Kent local protection project is located in the town of Fort Kent, Aroostook County, Maine, on the Saint John River at the confluence of the Saint John and Fish Rivers.

4. DESCRIPTION OF PROJECT. The project consists of earth dikes and concrete I wall; pressure conduit; two sluice gate structure; drainage facilities; raised roadway; and one pumping station.

5. EFFECTIVENESS OF PROTECTION.

a. The protective works on the Saint John River was designed for a river stage resulting from a 100 year frequency flood.

6. CONSTRUCTION HISTORY. The construction of the Fort Kent Local protection project was accomplished under one construction contract awarded in the amount of \$1,466,403.00 to H.E. Sargent Company, Inc., Stillwater, Maine. Notice to proceed with the work was given on 10 June 1976 and the project was placed in operation by October 1977.

7. PLANS. Plans pertinent to the operation and maintenance of the project are included for reference in Appendix "F" in this volume. The original tracings, when corrected to indicate "as-built" construction, will be forwarded to the town of Fort Kent.

8. LOCAL COOPERATION. The authorizing legislation for the Fort Kent project was the Flood Control Act of 1948, as amended by Section 61 of the Water Resources Development Act of 1974, Public Law 93-251, and reads as follows:

"a. Provide without cost to the United States all lands, easements, and right-of-way necessary for the construction of the project including lands for spoil disposal, storm water pondage, and collector ditches together with necessary changes in sewage systems, highway bridges and roads, railroad track except railroad bridges and approaches, and other utilities;

"b. Hold and save the United States free from damages due to the construction works;

"c. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army;

"d. Prevent encroachment on improved channels and on ponding areas and if capacity of the latter is impaired, provide equally effective storage pumping capacity, or both, without cost to the United States;

The assurances of the town of Fort Kent are contained in Appendix "D" of this volume. This Manual is to assist the town of Fort Kent in fulfilling the above responsibilities for maintaining and operating the project.

9. GENERAL RULES AND REGULATIONS. Paragraph 208.10 (a) of the regulations prescribed by the Secretary of War gives general rules for the maintenance and operation of structures and facilities constructed by the United States for local flood protection. Applicable portions are quoted below to avoid the necessity for cross reference and are further defined by remarks under each quotation.

"(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

These requirements cannot be overstressed, and town authorities must make adequate provisions for funds, personnel, equipment, and materials to allow for the proper maintenance and operation of the flood protective works.

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the 'Superintendent', who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during the periods of low water, all without cost to the United States."

The committee shall be composed of competent members, preferably persons experienced in engineering or construction work of a nature similar to the flood protection works. The committee must be given broad authority to carry out its responsibilities. The name, address, and office and home telephone numbers of the Superintendent, and any changes thereof, shall be promptly furnished the Division Engineer.

"(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times."

The town of Fort Kent shall procure approximately 3,300 grain or feed type bags, 200 cubic yards of sand for these bags and an adequate number of tools such as picks and shovels. Sufficient personnel shall be designated to implement the filling and placing of these sand bags in order to control sand boils and seepage behind the dikes and walls. Sand, bags and tools shall be stored in a central location with the sand stored separately. Borrow pits for embankment materials shall be secured and sources of additional supplies of materials shall be established in order that these articles can be obtained quickly in case of an emergency.

"(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities."

The disposal of rubbish, erection of fences, or barriers, the painting or erection of signs, the attachment of clothes lines to flood walls, or any form of trespassing on the project shall be prohibited.

"(5) No improvement shall be passed over, under, or through the walls, dikes, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the Division Engineer or his authorized representatives that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the Division Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the Division Engineer after completion of the work."

Any contemplated improvements or alterations as outlined above must be submitted to the Corps of Engineers, Waltham, Massachusetts, and the approval of the Division Engineer obtained prior to the town authorizing the work. All requests for approval shall be in writing and complete drawings in duplicate, one set of which shall be in reproducible form, must be submitted along with a full description of the work intended. The town will be held responsible for obtaining prior approval from the Corps of Engineers for any improvements or alterations proposed by itself, private parties or any public parties. The town shall furnish the Division Engineer as-built drawings, in sextuplicate, of the completed work.

"(6) It shall be the duty of the Superintendent to submit a semi-annual report to the Division Engineer covering inspection, maintenance, and operation of the protective works."

See Paragraph 12 of this Manual for instructions on submitting reports.

"(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

The Division Engineer or his representatives will make periodic inspections of the protective works to determine if the project is being properly maintained and operated by the town. "Follow-up" inspections, when necessary, will be made to determine if deficiencies observed during the inspection have been corrected. A report with the results of each inspection will be furnished to the town of Fort Kent for appropriate action.

"(8) Maintenance measures or repairs which the Division Engineer deems necessary shall be promptly accomplished."

The town should maintain the facilities and keep them in good repair and not wait for the Division Engineer to call such matters to its attention. Upon request, the Division Office will advise the town how to make any major repairs to the facilities.

"(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

The town should formulate plans and negotiate agreements with local organizations and companies, who are operating facilities connected with the protective works, to insure that their activities will be properly coordinated with the Superintendent's organization during flood periods.

"(10) The Corps of Engineers, with this document, has furnished local interests with an Operation and Maintenance Manual for the completed project to assist them in carrying out their obligations under these regulations."

The flood control committee should familiarize itself with the contents of this manual. The town authorities are encouraged to call on the Division Office of the Corps of Engineers for any additional advice or instructions required by them in carrying out the town's obligations for maintaining and operating the flood protection facilities.

#### 10. MAINTENANCE.

a. The word "maintenance" as used in this manual applies to the upkeep, repair and care of the work constructed by the Government and turned over to the town of Fort Kent. If the work is neglected there will be deterioration and possible failure during a potential flood when there is need of dependable protection.

b. Satisfactory and dependable operation depends on constant maintenance. The organization that performs maintenance must be familiar with various parts of the system and will be in a position to use them effectively in time of need.

c. Maintenance includes regular inspection of the entire system. The purpose of an inspection is to detect any deterioration or faulty operation that indicates a need for repair or replacement. Inspection should be accomplished by persons walking from one extreme of the system to the other and visually inspecting each feature at close quarters.

d. In addition to inspection, sluice gates and pumping station equipment require testing at stated intervals to insure proper operation of all components.

e. During the winter months it may be necessary to inspect certain project features in order to insure that no problems exist that could delay the operation of the project in the event a sudden thaw and rain storm occurs. The Superintendent should prepare a check off list of potential problems. This list should provide that:

(1) Pumping station gates are free of ice and debris.

(2) Conduit and drainage structures, entrances and openings are free of debris, leaves, snow and ice.

(3) Sluice gate structures are accessible.

This list should be expanded as experience indicates.

f. Each of the major features of the project is discussed separately. Particular emphasis is placed on those points which, based on experience with special project features, require special attention.

#### 11. OPERATION.

a. Operation in this manual refers to the actual use of the various features of the protection works during flood periods. It is intended that the procedure outlined herein under Appendix "B" will be sufficient to insure protection from floods to the design stage. However, advice relative to operation may be obtained, during working hours, from the Reservoir Control Center (Telephone 617-894-2400, Ext. 627) of the New England Division office.

b. Representatives of the Division Engineer stand ready to assist the town of Fort Kent in the operation of the project. This in no way lessens the responsibility of the town of Fort Kent in operating the project.

c. When abnormal river flows and stages are expected it is important that the Superintendent make immediate decisions, take prompt action and have the authority to carry out his decisions.

d. To insure correct operation it is essential that at least two persons (preferably 3): (1) Be familiar with all phases of the flood protection works; (2) Know when to start the pumping station; (3) Know the location of all gates and valves and when to close them; (4) Know just what supplies and transport are on hand; (5) Know what men and tools can be mobilized for the patrolling and repair work.

e. Arrangements should be made with the National Weather Service in Portland, Maine to keep the town informed on flood predictions.

f. It will be to the advantage of the town to negotiate agreements with private owners and companies to operate and maintain project features that are directly related to facilities and property of those parties. However, the Corps of Engineers will look to the town for maintenance and operation of the project since the town executed assurances of local cooperation.

12. INSPECTION AND REPORTS. The regulations prescribed by the Secretary of the Army call for semi-annual reports to be submitted by the Superintendent to the Division Engineer covering inspection and maintenance. Inspection of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods, and otherwise at intervals not exceeding 90 days as required by the regulations.

To assist the Superintendent in making his inspections and reports, sample check list forms including blank NED Form 513 and sample forms marked Exhibits A, B, and C have been prepared and included in Appendix "C". The Superintendent shall have additional copies printed for use in submitting his reports.

The semi-annual reports shall be submitted in triplicate to the Division Engineer, Attention: Reservoir Branch, Operations Division, each February and August. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The reports shall cover the following points:

- a. A description of the maintenance work performed in the preceding six months.
- b. The number and classification of men working on maintenance, regularly and intermittently.
- c. Description of any work performed by contract on the repair or improvement of the project.
- d. Description of use or operation of the system during the period being reported.
- e. Suggestions relative to public cooperation and comments concerning public sentiment on the protection obtained are considered pertinent and desirable but the inclusion of such data is not required.

## B. DIKES

13. DESCRIPTION. There are dikes along the right bank of the St. John River. The dikes are rolled earth filled, with stone slope protection along river sides, with topsoiled and seeded land slopes and with road gravel top surfaces. The thickness of the stone protection varies as required by the various velocities in the channels. The height of the dikes vary from 5 to 12 feet. The land side slopes are 1 on 2; the river side slopes are generally 1 on 2.5.

14. MAINTENANCE. Paragraph 208.10 (b) (1) of the prescribed regulations sets forth rules for the maintenance of levees. For the purpose of this manual the words "levees" and "dikes" are interchangeable. These rules quoted for levees apply equally to earth dikes, and applicable portions are quoted below. Following this, points that apply particularly to the Fort Kent project are discussed.

"Dikes. (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, to exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces.

"To prevent development of possible piping channels and discontinuities which may lead to erosion of embankments by flowing water, trees or shrubs will not be planted on the sides or top of embankments. Areas of natural ground riverward of dikes may be considered for planting. However, in each case, the effect of the plantings on total performance of the project must be assessed, and the proposal submitted to the Division Engineer for prior approval. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

"(i) No unusual settlement, sloughing or material loss of grade or levee cross section has taken place;

"(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

"(iii) No seepage, saturated areas, or sand boils are occurring;



"(iv) Toe drainage systems . . . . are in good working condition, and that such facilities are not becoming clogged;"

The project includes underdrain pipes along the land side toes of the dikes and along the back of all walls for nearly the full length of their reaches. In general the underdrains are constructed in straight runs between observation risers and manholes. During low water periods, and at least once a year, the underdrains should be inspected to determine if sections of the drains are crushed or are partially or fully filled. One method to inspect condition of drains, when drains are in straight runs and terminate in a manhole at one or both ends, is by placing a light at the end of the run in an observation riser or manhole and detect the condition of run by placing a sloping mirror (similar to an inverted periscope) in adjacent observation riser or manhole. If the inspection indicates any filling or obstruction in a pipe, the pipe shall be cleaned out by flushing and where necessary by use of rooters or by excavation or by replacement. For other runs, inspection shall be as outlined in paragraph 18 when the river is at least five feet above toe of dike.

"(v) Drains through the levees and gates on said drains are in good working condition;

"(vi) No revetment work or riprap has been displaced, washed out or removed;

"(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

"(viii) Access roads and ramps to and on the levee are being properly maintained:

"(ix) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

"( x ) There is no unauthorized grazing or vehicular traffic on the levees:

"( xi ) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during time of emergency.

"Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent."

Any unusual settlement, sloughing or caving should be corrected to restore the original dike grades. No major repair work shall be made without prior approval of the Division Engineer, in order that such repairs that may be necessary will not adversely affect the functioning of the protective facilities.

The landside slopes of dikes and the tops of the dikes, except for roadways, were topsoiled and seeded to minimize the damage from erosion and scour caused by surface runoff. Maintenance of a sturdy sod growth on dike embankments is highly important as sod is one of the most effective means of protecting the levee against erosion from rain, current and wavewash. Periodic mowing is essential to maintaining a good sod growth, and should be done at such intervals as necessary to keep down weeds and other noxious growth and to prevent the grass height from exceeding 12".

When sections of the dikes require reestablishment of turf, seeding operations should be started at the earliest practical date in the spring to secure the greatest possible protection against erosion. Areas requiring seeding shall be dressed to fill gullies and irregularities in the surface. The following seed mixture was used in the original construction:

TABLE I

GRASS SEED

Kind of Seed	Percentage by Weight In Mixture	Minimum Percentage Purity	Minimum Percentage Germination
For slopes graded at the rate of 4:1 and steeper.			
Creeping Red Fescue	40	85	80
Kentucky Bluegrass	25	85	80
Kentucky 31 Fescue	20	85	80
Red Top	10	85	80
White Clover	5	85	80
For all other grass plots.			
Creeping Red Fescue	45	85	80
Kentucky Bluegrass	30	85	80
Italian or Perennial Ryegrass	15	85	80
Red Top	10	85	80

Note: Weed seed shall not exceed 1.0% of total mixture by weight.

Inspections of the dikes shall be made during and after periods of high water, as it is at such times that any weak spots will be discovered that might otherwise be overlooked.

All stone protection shall be kept free of vegetation growth.

All observation risers shall be properly maintained.

15. OPERATION. Paragraph 208.10 (b) (2) of the prescribed regulations sets forth rules for the operation of levees. These rules apply equally to earth dikes and are quoted below. Following these, a few of the points which apply particularly to the Fort Kent project will be discussed.

"(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

"(i) There are no indications of slides or sloughs developing;

"(ii) Wave wash or scouring action is not occurring;

"(iii) No low reaches of levee exist which may be overtopped;

"(iv) No other conditions exist which might endanger the structure.

"Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

Operation of the dikes may be at a time of moderately high water, such as a spring freshet, or may be when unusual conditions indicate the possibility of dangerous flood heights. Prompt action in starting work is of the utmost importance.

Requirements for patrolling the dikes depend on the depth of water on the river side of dike. Patrolling of the dikes should start when the water surfaces of the river and/or brook reaches the same elevation as the surface of the ground on the land side of the dikes and floodwalls. The patrolling should continue until the flood has reached its peak and receded below the elevation of the land side ground.

The underdrains and observation risers along both dikes and walls should be inspected during and following each major high water period and otherwise at intervals not exceeding one year. They can best be inspected by noting the flow or rise of water in observation risers. If water rises in an observation riser, a constriction is indicated and the constriction should be cleaned out.

The water level in observation risers shall be recorded at least twice daily to determine proper functioning of the underdrains whenever the rivers rise 5 feet above the elevation of the surface of the ground on the land side of the dikes and floodwalls.

Patrolmen should be thoroughly instructed as to their duties, what they are to watch for, and the exact limits of their beat. On each journey of inspection they should carefully examine both slopes of the dikes for seepage or wetness on landside slope, sand boils on landside of dike, wave wash or scouring on riverside slope, and indications of slides or sloughs on either slope.

All unauthorized traffic on the dikes should be stopped at once, and patrolmen should be instructed to keep people off the dike unless they can show passes or credentials authorizing their presence.

16. EMERGENCY REPAIR MEASURES. Scours. Careful watch should be maintained of the dike for indication of scouring. If any indication of scouring is observed, soundings should be taken to observe the amount and progress of the scour. Sandbagging or dumped rock will generally afford the most practicable means of combatting this condition. The open ends of sandbags so used must be sewed or tied after filling.

Wave wash. Wave action may cause displacement of stone protection and wash-out of earth materials on the riverside slopes of the dikes. Well-sodded slopes will usually withstand waves from a storm of about an hour's duration without serious damage. An attack over a longer period may become serious and the slopes should be protected by sacking or equivalent means. The extent of washes can be determined by wading along the attacked slope. Sandbags should be placed in the erosions in as effective a manner as possible, carrying the protection well above the action of waves. Sandbags used for this purpose require only about one-half cubic foot of material and should be sewed or tied. The aim is to obtain a maximum of coverage with only sufficient weight to hold the sack in place.

Sand Boils. a. General. A sand boil is the result of a transfer of pressure head and seepage from the river, through a pervious stratum near or at the surface, to the landside of the dike. This seepage under pressure tends to push its way to the surface and actually floats the material through which it flows. No harmful effect results provided the weight of the relatively impervious soil layer overlying the pervious stratum, in which the flow under pressure is occurring, is sufficient to counterbalance this pressure. When the soil stratum overlying the pervious layer is insufficient to counterbalance the upward pressure or when no such stratum exists, boils break through the surface on the landside

wherever these weaknesses are present. The sand boil may discharge relatively clear water or the discharge may contain quantities of sand and silt, depending upon the magnitude of the pressure and the size of the boil.

b. Effects of sand boils. Sand boils can produce three distinctly different effects on the levee, depending upon the condition of flow under the levee. These three effects are illustrated in Appendix "E". In Figure 1, Plate No. I, the seepage flow develops a definite pipe or tube under the levee. This breaks out at the landside toe in the form of one or more large sand boils. Unless checked, this flow causes a cavern to be developed under the levee, resulting in subsidence of the levee and subsequent overtopping. This case can be most easily recognized by slumping of the levee crown. Figure 2, Plate No. I of Appendix "E", illustrates the case where seepage flows under pressure under the levee without following a defined path, as the case above. This flow results in one or more boils outcropping at or near the landside toe. The flow from these boils tends to undercut and ravel the slope, resulting in a sloughing of the slope. Evidence of this type of failure is found in undercutting and ravelling at the landside toe. Figure 3, Plate No. I, of Appendix "E", shows a third type of effect of a sand boil. In this case, numerous small boils, many of which are scarcely noticeable, outcrop at or near the toe. While no boil may appear to be dangerous in itself, the consequence of the group of boils is to cause flotation of the soil, thereby reducing the shearing strength of the material at the toe, where maximum shearing stress occurs, to such an extent that failure of the slope through sliding results.

c. General instructions for handling sand boils. All sand boils shall be watched closely. A sand boil which discharges clear water in a steady flow is usually not dangerous to the safety of the dike. However, if the flow of water increases and the sand boil begins to discharge material, corrective action shall be taken immediately.

d. Method of treatment.

(1) The accepted method of treating sand boils is to construct a ring of sandbags around the boil, building up a head of water within the ring sufficient to prevent further movement of sand and silt. The accepted method of ringing a sand boil, shown on Plate No. II of Appendix "E" is as follows:

(a) The entire base of the sack ring is cleared of debris in order to provide a watertight bond between the natural ground and the sack ring.

(b) The sacks are then laid in a ring around the boil, with joints staggered, and with loose earth between all sacks.

(c) The ring is carried only to a height sufficient to prevent material from being discharged. The ring should not entirely stop the flow of water, because of the probability of the excessive local pressure head causing additional ruptures of impervious strata and boils nearby.

(d) A "V" shaped drain constructed of two boards, or a piece of sheet metal, is then placed near the top of the ring to carry off water.

(2) Actual conditions at each sand boil will determine the exact dimensions of the ring. The diameter and height of the ring depend upon the size of the boil, and the flow of water from it. In general, the following considerations should govern:

(a) The base width should be no less than 1-1/2 times the contemplated height.

(b) It is well to include weak ground near the boil within the ring, thereby preventing a break-through later.

(c) The ring should be of sufficient size to permit sacking operations to keep ahead of the flow of water.

(3) Where many boils are found to exist in a given area, a ring levee of sandbags shall be constructed around the entire area and, if necessary, water pumped into the area to provide sufficient weight to counterbalance the upward pressure.

Sloughs. During prolonged high water stages, seeping and sloughing conditions on the landside slopes may occur. Such conditions should be observed closely as to progress of seepage up the landside slope and the amount of material that is being carried by seepage. If the seep velocity becomes great enough to cause, or probably cause, erosion or sloughing of the slope, a sandbag covering should be placed on the seeping area, beginning well out from the toe and progressing up the slope. The covering should extend several feet beyond the saturated area. If the material is obtainable, the affected area should be covered with brush, straw or similar permeable material to a depth of two to four inches before placing the sandbag cover. This will permit the seep water to get away while serving as a filter to prevent loss of earth from the dike. After the covering is placed, close observation should be maintained and additional layers of sandbags placed on the previous ones until the velocity of the seepage is reduced to a point at which the amount of material carried is negligible. Sacking sloughs are illustrated on Plate No. III of Appendix "E".

Raising existing earth dikes. In an emergency, time and other conditions permitting, the grade of a dike can be safely raised three feet. The methods most commonly used for this purpose are outlined in the following paragraphs.

a. Sandbag topping. The sack ordinarily used for topping an earth dike shall be a grain or feed type sack (in lieu of canvas or sisal-craft type) which holds 100 pounds of grain. Smaller sacks may be used if feed sacks are not available. Grain sacks, filled with about one cubic foot of earth, weighing about 100 pounds, will provide a unit about six inches high, one foot wide and two feet in length.

The sacks may be filled at the source of material and hauled to the dike or filled from stockpile or borrow areas at the dike, conditions determining the method employed. The same is true of filling; i.e., whether power or hand methods are used.

The open end of the sacks should always face upstream or toward the riverside of the dike and need not be sewed or tied. When the sack faces the river the loose end should be folded under and when facing upstream the loose end covered by the succeeding sack.

The front line of sandbags in the first layer should be laid parallel to the dike center line and remaining bags at right angles to the center line. The sandbags in the second layer are all laid at right angles to the center line, the third row similar to the first, etc., as shown on Plate No. IV of Appendix "E". All sacks should be lapped about  $\frac{1}{3}$  each way and well mauled or tramped into place. The sacks should be filled to two-thirds their capacity when flattened out to facilitate proper placing and prevent bursting the sack when mauled or tramped into place.

Plate No. IV of Appendix "E" illustrates the progressive method of increasing the dike height and gives an approximation of the number of sacks required for dikes of various heights. Plate No. V of Appendix "E" shows pictures of model sack dike or topping.

A crew of 160 men should fill, carry and place approximately 5,000 sacks per eight-hour day, all hand labor, when the source of material is within 150 feet of the point of placement. Production will depend on conditions at the site, location of storage and loading areas, and type of bag filling equipment used.

b. Lumber and sandbag topping is the most satisfactory method of raising low reaches of earth dike in emergencies. The chief objection is the time required to install. In putting on this topping, as well as any other topping, a careful line of levels should be run and grade stakes set in advance unless the dike top follows a dependable grade line. Two-by-four or two-by-six inch stakes should then be driven on the river side of the crown six feet apart and one-by-twelve inch boards nailed to land side of the stakes. This wall, backed with a single tier of sandbags, will hold out at least one foot of water. If the second foot is necessary, the layers of bags will have to be increased in number and reinforced. Sandbags are laid substantially in the manner described in a above. The stakes should be driven at least three feet into the ground, leaving at least three feet out, which will, in extreme cases, hold a three-foot topping if properly braced behind the sandbags. Plate No. VI of Appendix "E" illustrates this method of raising a dike.

### C. FLOODWALLS

17. DESCRIPTION. The floodwalls are Type "I" of reinforced concrete construction with waterstops at all joints. Only the upper parts of the walls are visible since the fill and drainage materials placed on both sides of the wall have been back-filled and compacted. In most instances, the channel side slopes and the stone protection abut the river side of the wall.

18. MAINTENANCE. Paragraph 208.10 (c)(1) of the prescribed regulations sets forth rules for the maintenance of floodwalls. Applicable portions of these rules are quoted below.

"Periodic inspections shall be made by the Superintendent to be certain that:

"(i) No seepage, saturated areas, or sand boils are occurring;

"(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

"(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

"(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

"(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

"(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

"(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

"(viii) Toe drainage systems . . . . . are in good working condition, and that such facilities are not becoming clogged."

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. See instructions under Section C "Dikes" for



maintenance of underdrains. All repairs shall be accomplished by methods acceptable in standard engineering practice.

19. OPERATION. Paragraph 208.10 (c) (2) of the prescribed regulations gives rules pertaining to floodwalls during periods of flood emergency.

"Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall."

20. EMERGENCY REPAIR MEASURES. The Superintendent or responsible members of his organization shall take immediate action to correct any condition which endangers the stability of the wall. All such measures taken will be reported to the Division Engineer immediately after the flood period.

Sand Boils. See Paragraph 16 for emergency measures to be taken in the event sand boils develop.

Monolith Joints. Appreciable leakage through vertical monolith joints can be controlled by dumping cinders, sawdust, or similar material on the riverside of the wall. The dumped material will be carried into the joint by the water and plug the leak.

Raising Grade of Wall. In an emergency, the walls may be raised temporarily by a single row of sandbags or by erecting wooden flashboards as shown in Plate VII of Appendix "E".

#### D. DRAINAGE STRUCTURES (Sluice Gate Structures)

21. DESCRIPTION. Sewer lines and storm drains that pass under the protection and channel are shown on general plan and utility sheets included in Appendix "F" of this Manual. The sewer and drainage sluice gate structures connected with the project are described below. See drawings for location of pressure, special drainage structures and standard underdrain, drain and sewer manhole structures not included as a sluice gate structure. The sluice gate structures are provided with gates, access covers, ladders, pipe railings, etc. as applicable to make a reliable, workable and complete installation.

##### a. Pertinent Data - Sluice Gates Structures

Structure No. 1	48" x 48"	Manually or Mechanically*
Structure No. 2	48" x 48"	Manually or Mechanically*
Pumping Station		
2	36" x 36"	Manually or Mechanically*

\*Portable, modified chain saw engine

b. Construction. All sluice gate structures are of concrete construction of various sizes and configurations with access through top of structure. See drawing for various types of construction covering other type drainage structures.

c. Sluice Gate Operation. Each sluice gate can be manually or mechanically (portable chain saw engine) operated. The design of the project is such that the gate in Structure No. 2 will be required to be closed in time of flood control operations. Gate No. 1 will be required to be closed only in the event of a break (fracture) in the pressure conduit.

d. Pressure Conduit. At no time in the future shall the town permit anyone to tie into the pressure conduit, noted on plan as 48" R.C.P. These pipe lines are a vital part of the overall protection, and considerable damage will result to protected areas if other drain lines are connected to the pressure conduit.

22. MAINTENANCE. The lines and drains passing through the protection should be adequately maintained and any breaks or leaks promptly repaired. Where any excavations are necessary, backfills shall be carefully and thoroughly compacted, taking care that no voids or nests of cobbles or gravel are allowed to occur. Paragraph 208.10 (d)(1) of the prescribed regulations gives rules for the maintenance of sluice gate and other drainage structures.

"Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Periodic inspections shall be made by the Superintendent to be certain that:

"(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

"(ii) Inlet and outlet channels are open;

"(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

"(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

"Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections."

Locations where sewer lines and storm drain effluents are discharged onto the stone protection should be examined periodically to insure that there is no loss of stone material.

The stems of all gates should be kept completely coated with a water resistant lubricant at all times to prevent corrosion and provide lubrication. All drainage and sanitary structures including special drainage and standard manholes shall be inspected at least once a year and all collected debris shall be removed.

All metal surfaces not otherwise protected must be kept painted to maintain the metal in good condition. The exterior and interior metal work, such as ladders, sluice gates, pipe railings and cover plates, exterior gate hoist and flap valves, will require frequent painting because of exposure to the weather and/or to waters.

23. OPERATION. Paragraph 208.10 (d)(2) of the prescribed regulations gives rules for operation of sluice gate structures. These rules are quoted below.

"Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Manually operated gates and valves shall be closed as necessary to prevent inflow of floodwater. All drainage structures in dikes shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition."

As long as sewer lines and storm and other drains and ditches into the channel are draining freely they should present no special operating problems.

The requirements of Paragraph 208.10 (f)(2) of the prescribed regulations which governs the operation of pumping stations applies to the operation of the drainage and sluice gate structures.

Competent operators shall be provided whenever it appears that necessity for gate operation is imminent. The operators shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operators shall be familiar with the equipment manufacturer's instructions and drawings and with the "Operating Instructions" for each sluice gate structure. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the gate shall be thoroughly cleaned and equipment thoroughly inspected, oiled and greased. A record or log of operation shall be kept for each gate, a copy of which shall be furnished the Reservoir Control Center following each flood.

## E. PUMPING STATION

24. DESCRIPTION. The purpose of the pumping station, constructed by the Corps of Engineers in the town of Fort Kent, is to dispose of the interior drainage during high water periods. The station is provided with sufficient pump capacity with one pump inoperable to discharge two-thirds of the design runoff based on the existing developments in the drainage areas. The storm water pumps are driven by diesel engines directly connected through flexible couplings to right angle gear units which transmit the power to the vertical pump shaft. The pumps are vertical, fixed blade, propeller type of standard construction using steel columns and discharge elbows, cast iron bowls and suction bells, bronze impellers, stainless steel pump shafts, and bronze bearings. Each pump is provided with a electric motor operated centralized lubrication system. The station is provided with other facilities, such as louvers, sluice gates, vent fan, sump pump, etc., to make a reliable, workable and complete instation.

### a. Pertinent Data - Fort Kent Pumping Station.

1. Drainage Area - 62 Acres.

#### 2. Pumping Station

Number of Pumps	2
Capacity (each)	9,000 gpm 14.7 Static Head
Horsepower	75
Building Size	75' -0" x 25' -0"

b. Pumping Station. The station is located behind the protection. The outside dimensions of the brick and concrete structure are 26' -0" x 25' -0". The intake chamber is 4' -0" wide, while the gravity flow discharge is in a 4' -0" wide chamber leading to a 48" gravity conduit pipe. Flood discharge will be by two (2) 18" steel pipes carried over the dike.

1. Pumping Equipment. Two pumps are provided with each pump having a capacity of 20 cfs (9,000 gpm), two-thirds of the required station capacity, against the design flood with suction sump of high water elevation. Each pump is driven by a diesel engine through a right angle gear unit. The pumps are vertical, fixed blade, propeller type of standard construction using steel columns and discharge elbows, cast iron bowls and suction bells, bronze impellers, stainless steel pump shafts and bronze bearings. Each pump is provided with electric motor operated centralized lubrication system. Each pump is capable of operation against all river stages up to the top of the dike. Each pump discharges over the top of the dike. Two sluice gates, one located in front of each pump, will seal off the pump sump except when opened for activation of the station. A sluice gate is provided on the river side of the dike in a sluice gate structure to close off the gravity flow conduit.

2. Sluice gates. Each sluice gate at the pumping station is a seating pressure type of standard cast iron construction with bronze seals. Floor stands have been installed for operation of each gate. Each sluice gate can be manually or mechanically (portable, modified chain saw engine) operated.

a. Manual Operation - The project has been provided with 4 (four) handcranks.

b. Mechanical Operation - The project will be provided with a lightweight gasoline chain saw engine with a reduction gear attached driving a splined shaft which is then coupled to the input shaft on the sluice gate stand for operation.

3. Sump Pump. An electric motor operated wet pit type sump pump is provided in the pumping station for dewatering and for handling any leakage into the sump. An alarm will sound when the water level in the sump drops to 3 feet and the pumps will automatically shut off when the water drops to 2 feet.

4. Heating. The pumping station is equipped with oil fired forced warm air furnace, thermostatically controlled to maintain inside temperature at 55°F. The furnace shall be maintained operational in order to insure that this minimum temperature is maintained in the pumping station throughout the year. In addition, a humidistat will override the thermostat to operate the heater as necessary to maintain the relative humidity at not higher than 50%.

5. Ventilation. A small fan with ductwork is provided for ventilation of the sump. The diesel engines are radiator cooled with each radiator connected to exterior wall louver by ductwork to prevent short circuiting of cooling air. Inlet louvers are provided for air supply to the radiators.

6. Water level indicators. Indicators for both the station sump and the river water levels are provided.

7. Electric service. Electric service is obtained from the Maine Public Service Company. Service is 240V, single phase, 3 wire. The service is extended from existing lines along Main Street and run overhead approximately 300 feet along the new access road and then underground to the station. All interior conductors have heat and moisture resisting type insulation and are installed in rigid steel conduit. Conduit has been installed for use by the Continental Telephone of Maine for providing future telephone service.

## 25. MAINTENANCE.

a. Regulations. Paragraph 208.10(f)(1) of the prescribed regulations governs the maintenance of the pumping station.

"Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant,

buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for diesel powered equipment, and flashlights or lanterns for emergency lighting shall be kept on hand at all times. An empty conduit has been provided at the station so that telephone service can be provided by the town at the pumping plant. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. The results of the megger tests shall be forwarded to the Division Engineer, Attention: Project Operations Branch, Operations Division. In addition, a record shall be kept by the Superintendent showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off flood seasons insofar as practicable."

b. Recommendations of Division Engineer. To help carry out the above quoted regulations, the Division Engineer recommends the following:

(1) General. Proper maintenance of the pumping station requires periodic operation of all equipment at frequent intervals to keep equipment in good working order and all parts well lubricated and free from corrosion. Periodic operation of equipment also permits an inspection of the functioning of all equipment so that defective parts may be properly replaced or repaired before their use is required for pumping operations. Inasmuch as mechanical and electrical equipment deteriorates rapidly from idleness as well as from continued use, a thorough and complete maintenance routine is justified.

(2) Diesel engines.

(a) Twice a year, in the spring and fall, each engine should be run for two hours. The operation of the engines for this length of time is necessary to get the crankcase oil warmed up sufficiently to evaporate any fuel that entered the crankcase during starting and to evaporate any moisture that is in the crankcase oil due to condensation. If the station is operated for flood purposes during either of these periods, this operation will meet the maintenance operation requirement. During this period of operation, the cut-out coupling between engine and gear unit shall be set so the pump does not operate. The functioning of the engine and accessories should be checked for proper performance. The following are the principal items to be checked:

Oil Pressure  
Water Temperature

(b) Once each month, each engine, gear unit, and pump shall be operated for two or three minutes. This two to three minute operation may be run with the sump dry. DO NOT OPERATE ANY PUMP LONGER THAN THREE MINUTES DRY. This two to three minute operation will demonstrate that the engine will start properly and will be sufficient to circulate oil in the engines and gear units to all surfaces and will spread a grease coating on the grease lubricated shafts and bearings. If this short period of operation indicates any unusual noises in the pump or gear units, the unit should be shut down immediately, the sump flooded and the unit operated as necessary to determine the source of trouble and necessary repairs.

(c) Oil in the engines should be changed twice a year or after every 100 hours of operation, whichever is more frequent. At the time of oil changing, the oil filter should be removed and replaced with new filter element.

(d) The drain valve at the base of the vertical exhaust pipes should be opened once a month while the engine is in operation to allow the condensate collected in the pipe to drain before it collects sufficiently to back up into the exhaust manifold and into the cylinders.

(e) Antifreeze no longer requires draining at the end of each cold weather season; it may be retained in the cooling system for an extended period dependent on the outcome of a hydrometer test accomplished during performance of scheduled Preventative Maintenance Service on the engine. Rust inhibitor shall be added annually. Permanent type antifreeze shall be used at all times and shall be adequate for protection against freezing at minus 30° F.

(f) All manually operated louvers shall be opened prior to starting engines.

(3) Pumps. No maintenance of the propeller pumps is ordinarily required except that necessary to keep them painted and lubricated. The Farval grease lubricator on each pump should be operated to pump grease to each grease lubricated bearing prior to each pump operation and after each half hour during continuous operation. After each "wet sump" pump operation, the inside of the pump column, discharge elbow and the propeller and suction bell shall be flushed clean with hose using water from tank truck.

(4) Gear units. The gear units are fully enclosed oil lubricated. The oil level must be kept at the indicated level in the sight glass at all times. The oil in the gear units should be changed every two years.



(5) Sluice gates. The sluice gates should be operated a few inches of travel each month and through full travel once yearly. The stems of all gates should be kept completely coated with a water resistant lubricant at all times to prevent corrosion and provide lubrication.

(a) Mechanical gate operator - The portable gasoline chain saw engine should be stored in the pump station in a safe, readily available location and shall be maintained operable at all times. Manufacturer's instructions relative to maintenance and attachment of the unit to the sluice gates will be provided. These instructions shall be maintained in the portable operator storage. This unit shall be tested on the gates when the gates are tested. A small can (approved for volatile fluid storage) of gasoline shall be obtained and stored in the same location with the portable operator. The portable operator is a standard chain saw engine and, as such, can be repaired by any chain saw repair facility.

(b) Gate handles - Gate handles shall be stored in a safe, readily available location in the pump station.

(6) Sump pumps. The pumping station is provided with a sump pump to handle any seepage into the sump and to evacuate the sump after each pumping operation. The pumps and motors should be lubricated annually and the float mechanism checked monthly by manually raising and lowering the float to start and stop the pump. Sump pumps are provided with "Manual-Off-Automatic" switch. Switch shall be in Automatic position at all times except when station sluice gates are open to station sump in which case they should be placed in the "off" position. The "Manual" position of the switch should only be used in an emergency and only under constant surveillance of the water elevation in the sump. DO NOT ALLOW THE PUMP TO OPERATE MORE THAN ONE MINUTE WITHOUT WATER.

(7) Painting. All metal surfaces not otherwise protective must be kept painted to maintain the metal in good condition. The exterior metal work, such as pipe railings, trash racks, cover plates, exterior gate hoist, hoist housings, and flap valves will require frequent painting because of exposure to the weather.

(8) Pump sump. After each period of high water during which the propeller pumps have been used, the sump should be emptied of water and the sump cleaned of all silt and debris. Most of the deposit on the floor can be washed into the pump sump by a stream of water from a hose and then removed with the sump pump. Any large debris, sticks, stones, rags, etc., should be removed manually. After the sump has been cleaned, the sump pump should be cleaned of all foreign matter.

(9) Anchor bolts. At yearly intervals, all anchor bolts, piping bolts, Dresser coupling bolts, pump assembly bolts, and all similar parts shall be checked for tightness and tightened if necessary.

(10) Lubrication. The two main requirements to keep equipment well lubricated are to operate equipment frequently to spread a film of lubricant over the bearing surfaces, and secondly to use proper kinds and grades of good lubricants. Cup greases should not be used on the equipment for any purpose because most cup greases have water as a binder. This moisture in contact with idle metal surfaces will corrode them in time. The types and grades of grease and oils should be in accordance with the equipment manufacturer's recommendations.

(11) Manufacturer's drawings and recommendations. The Corps of Engineers has furnished the town of Fort Kent a complete set of manufacturer's drawings pertaining to the mechanical and electrical equipment in the pumping stations. These drawings should be kept in good condition by the town of Fort Kent and available for reference at all times. If, for any reason, the drawings become damaged or lost, they should be replaced. The manufacturers will replace drawings for a nominal cost. The Operating and Maintenance Instructions of the engine manufacturers should be followed for diesel engine care.

## 26. OPERATION.

a. Regulations. Paragraph 208.10(f)(2) of the prescribed regulations governs the operation of pumping stations.

"Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operators shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operators shall be familiar with the equipment manufacturer's instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the Division Engineer following each flood."

## F. MISCELLANEOUS FACILITIES

27. DESCRIPTION. Miscellaneous structures and facilities constructed as part of the protective works include the timber staff gage in Sluice Gate Structure No. 2, pavements, flap gates in underdrain system not covered elsewhere, chain link fencing, and highway railing.

### 28. MAINTENANCE.

a. Paragraph 208.10(h)(1) of the prescribed regulations governs the maintenance of miscellaneous facilities:

"Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay."

### 29. OPERATION.

a. Regulations. Paragraph 208.10 (h)(2) of the prescribed regulations governs the operation of miscellaneous facilities.

"Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the Division Engineer unless designed therefor."

b. Debris Removal. During a flood or heavy rainfall, observations for collection of debris should be made along the dike stone protection. Debris could block the flow of water to pressure conduits and to the drain inlets. Men and equipment should be available within reasonable time and distance to assist in debris removal wherever necessary.

## G. OPERATIONS PLAN

30. PROJECT OPERATION. A plan of operation for floods is covered in Appendix "B". Severe floods can occur at any time of year. Fortunately, a few hours warning time should be available for local authorities to mobilize men and equipment for serious flood conditions. However, trained operators will be required at the Fort Kent Pumping Station and manpower and equipment should be on call for duty on the various project features to insure maximum project operation and efficiency.

31. COOPERATION. Representatives of the Division Engineer stand ready to assist the Town in the operation of the project. This in no way lessens the responsibility of the State of Maine or the town in the operation of the project.

#### H. DRAWINGS AND SPECIFICATIONS

32. DRAWINGS AND SPECIFICATIONS. A complete set of contract drawings and specifications was furnished the town of Fort Kent at the time of initiation of project construction. A full size set of drawings showing the project as actually constructed will be furnished the town of Fort Kent at the time of completion and transmittal of this manual; reduced prints of these drawings pertinent to the operation and maintenance of the project are included for reference in Appendix "F".

**APPENDIX A**

**REGULATIONS PRESCRIBED BY THE  
SECRETARY OF THE ARMY**

# TITLE 33—NAVIGATION AND NAVIGABLE WATERS

## Chapter 11—Corps of Engineers, War Department

### PART 208—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 23, 1936, as amended and supplemented (49 Stat. 1871; 50 Stat. 877; and 55 Stat. 639; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

**§ 208.10 Local flood protection works; maintenance and operation of structures and facilities—(a) General.** (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the Superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) **Levees—(1) Maintenance.** The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structure in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) The drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grading or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) **Operation.** During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual weakness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) **Flood walls—(1) Maintenance.** Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) The drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) **Operation.** Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at man-oil joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) **Drainage structures—(1) Maintenance.** Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(c) *Closure structures—(1) Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand-bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure all. Information regarding the proper method of erecting each individual closure structure together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(1) *Pumping plants—(1) Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephonic service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Merger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways—(1) Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities—(1) Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 55 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Reg. 9 August 1944, CE 57577)

[SEAL]

J. A. ULIO,  
Major General,  
The Adjutant General.

[P. M. Doc. 44-12285; Filed, August 16, 1944;  
9:44 a. m.]



APPENDIX B

STANDARD OPERATING PROCEDURE

DURING FLOOD PERIODS

APPENDIX B  
STANDARD OPERATING PROCEDURE  
DURING FLOOD PERIODS

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## APPENDIX B

### STANDARD OPERATING PROCEDURE DURING FLOOD PERIODS

#### SCOPE

#### 1. GENERAL

This appendix prescribes details for the operation of flood control features of the Fort Kent Local Protection Project prior to and during flood periods. Climatologic and hydrologic data are included for background information.

#### RESPONSIBILITIES

#### 2. TOWN OF FORT KENT

The Town is responsible for the operation and maintenance of the entire flood protection works. Instructions for the operation are presented in this appendix. Areas of responsibility include:

- a. Complete operation of the project during flood periods.
- b. Determining phases of preparedness, mobilization or operations based on: National Weather Service river and weather forecasts, Saint John River stages, or information obtained from the Corps of Engineers.
- c. Training personnel in specific duties and holding periodic practice sessions to insure efficient and effective maintenance and operation.
- d. Maintaining an adequate communication system with the National Weather Service to obtain weather and flood forecasts.

#### 3. CORPS OF ENGINEERS

The Reservoir Control Center (RCC) of the Corps of Engineers continually monitors rainfall and runoff conditions in much of New England. This climatologic and hydrologic information is available upon request. RCC will review operational procedures following major floods to determine whether the prescribed regulation instructions need revision.

#### 4. NATIONAL WEATHER SERVICE

The National Weather Service (NWS) has no direct role in the operation of the project. However, it has the responsibility of issuing weather and flood forecasts to the general public. Flood forecasts for the Fort Kent area are issued by the NWS office at Portland, Maine.

### CLIMATOLOGY

#### 5. GENERAL

A brief description of the climatology and recent flood history of the upper Saint John River basin is included as background information for the project superintendent and others concerned with the operation of the facility. It is intended that this information will allow operating personnel to become more aware of the weather and runoff conditions that result in flooding at Fort Kent.

The watershed above Fort Kent has a relatively cold climate with an average yearly temperature of about 40° Fahrenheit (F).

Because of the areas' northerly location, hurricanes have not produced as intense rainfall as in other regions of New England. The basin experiences periods of moderate and occasionally heavy rain and/or snowfall as a result of storms moving up the Saint Lawrence River, and to a lesser extent, storms moving up the Atlantic Coast. Showers are produced by frontal systems moving eastward across Canada.

#### 6. PRECIPITATION AND SNOWFALL

The average precipitation of about 36 inches is distributed rather uniformly throughout the year with slightly greater amounts during the summer months. Periods of moderate rainfall are usually not more than one or two days with amounts of one or two inches. The maximum and minimum yearly precipitation at Fort Kent is 50 inches and 25 inches, respectively. The average yearly snowfall of 95 inches represents 25-30 percent of the annual precipitation, with snowcover normally reaching a maximum in April. The average water equivalent of the spring snowpack is about 8 inches, with maximums as high as 15 inches. Table B-1 summarizes monthly precipitation and snowfall data.

TABLE B-1

PRECIPITATION DATA

<u>Month</u>	<u>Monthly Precipitation<sup>(1)</sup></u> (inches)			<u>Average</u> <u>Monthly Snowfall<sup>(2)</sup></u> (inches)
	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Snowfall</u>
January	2.16	4.63	.38	22.0
February	2.11	4.09	.88	21.0
March	2.37	5.86	.55	16.8
April	2.24	4.94	.74	5.2
May	2.81	5.87	.81	0.5
June	3.51	6.86	.47	Trace
July	4.16	10.51	1.42	-
August	3.90	9.97	.85	-
September	3.49	7.28	.41	Trace
October	3.24	5.77	.48	1.5
November	3.18	7.00	.21	8.7
December	2.62	5.24	.07	19.1
Annual	35.79	49.58	25.49	94.8

(1) 37 Years of Record

(2) 35 Years of Record

## 7. RUNOFF AT FORT KENT GAGE

The U. S. Geological Survey (USGS) maintains a stream gaging station at Fort Kent on the Saint John River, just downstream of the Fish River. The station has been in operation since October 1926 and provides a continuous record of river stage and discharge from 5,690 square miles of drainage area above the gage. These discharge records were used in the analysis of flood developments at Fort Kent; the various operating phases for the project are based on river levels at this gage.

The mean, monthly maximum and minimum discharges are summarized in table B-2.

TABLE B-2

MONTHLY DISCHARGES\*  
(cfs)

<u>Month</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>
January	3,010	7,438	871
February	2,200	7,479	562
March	3,030	23,590	669
April	22,040	48,910	3,298
May	36,850	68,160	14,580
June	10,690	21,800	3,616
July	6,270	14,770	2,214
August	5,370	21,040	910
September	5,080	14,700	935
October	6,130	17,610	1,116
November	7,940	22,720	1,367
December	5,350	22,900	1,232
Annual	9,628		

\*51 Years of record through WY 1976

HISTORY OF FLOODS

8. GENERAL

The annual peak discharge usually occurs during the snowmelt period in April and May. The greatest flood of record occurred on 1 May 1974 when a peak discharge of 148,000 cfs was recorded at the Fort Kent gaging station. Refer to plate B-6 for the stage-discharge rating table. The flood resulted from rapid snowmelt produced by several days of 60° temperatures and moderate rainfall, and was complicated by the sudden break up of a large ice jam about five miles upstream. Normally during a flood the river will rise about one or two inches per hour. However, due to the sudden ice break up during this event, the river rose about four feet in less than one hour.



The second largest flood occurred on 30 April 1973, when two inches of rain fell over the upper basin in a two-day period during a normal snowmelt period. A peak discharge of 136,000 cfs was observed at the USGS gage. Other notable floods occurred in the spring months of 1961, 1969 and 1933. A tabulation of the ten largest recorded floods is shown in table B-3. Data on floods before the establishment of the gage in 1926 is meager.

TABLE B-3

MAXIMUM FLOODS AT FORT KENT GAGE

<u>Date</u>	<u>Maximum Water Level</u>		<u>Peak Discharge</u> (cfs)
	<u>Stage in Feet*</u>	<u>Elevation-msl</u>	
1 May 1974	27.0	515.9	148,000
30 Apr 1973	25.8	514.7	136,000
16 May 1961	25.3	514.2	131,000
11 May 1969	25.1	514.0	129,000
11 May 1939	24.5	513.4	115,000
5 May 1933	24.3	513.2	121,000
26 Apr 1958	24.0	512.9	118,000
5 May 1942	24.0	512.9	114,500
9 May 1947	23.9	512.8	114,000
22 Apr 1941	23.6	512.5	109,000

\*Datum of Gage is 488.9 ft. above mean sea level (msl)

9. FREQUENCY OF FLOODING

In order to provide the Project Superintendent with a background on frequency of flooding at the Fort Kent gage, the following tabulation is included:

TABLE B-4

FREQUENCY OF FLOODING

<u>Frequency</u> (years)	<u>St. John River Level</u>		<u>Discharge</u> (cfs)
	<u>Stage</u> (feet)	<u>Elevation</u> (msl)	
100	29.0	517.9	175,000
50	28.0	516.9	159,000
20	26.0	514.9	138,000
10	24.4	513.3	122,000
5	22.7	511.6	105,000
2	19.5	508.4	79,000

## 10. ANALYSIS OF FLOODING

Flooding at Fort Kent most always occurs as a result of snowmelt, with larger floods caused by snowmelt augmented by moderate to heavy rainfall. Flooding can be significantly affected by the break up of ice jams upstream of the project, creating a surge of flow in the river, or can occur due to an ice jam immediately below the project causing high water. In either case, vigilance and caution must be exercised in project operation during the spring ice break up.

## 11. DESIGN FLOOD

Based on studies of costs versus benefits for various levels of design, the 100-year frequency flood stage of 29.0 feet (plus three feet of freeboard), was adopted as the design flood for the Fort Kent Local Protection Works. The design flood discharge of 175,000 cfs is 18 percent greater than the record flood of 148,000 cfs.

If the proposed upstream Dickey-Lincoln School Lakes Project is constructed, flood discharges at Fort Kent would be reduced by about 50 percent.

## DESCRIPTION OF OPERATIONAL ELEMENTS

### 12. GENERAL

This section briefly describes the elements of flood protection works and related equipment that town personnel will operate prior to and during floods. These elements consist of a pumping station, two sluice gate structures and two sewer valves. A general plan of the project is shown on sheets 1, 3, 4 and 5 of the as-built drawings.

### 13. INTERIOR DRAINAGE SYSTEM

Interior drainage from about 172 acres, delineated on plate B-5 is intercepted by the protective works. The interior area consists of a.) A 110 acre high level watershed which collects in a special drainage inlet then flows by gravity within a pressure conduit through the dike into the St. John River, and b.) A 62 acre low level watershed, which drains to the pumping station and thence by gravity flow or pumping into the St. John River. Both 48 inch conduits are designed to discharge runoff from a 100-year rainfall storm.

### 14. PUMPING STATION

A pumping station is required to pump the storm runoff from the low level area when the river levels are high. Normally this runoff will pass by gravity flow into the St. John River, however, when rising river levels approach flood stage, the 48 inch conduit is closed off at the sluice gate structure. The two sump gates are then opened, allowing the runoff to enter the pumping station, where it is pumped through two 18-inch pipes over the top of the dike into the river. The two pumps have a total discharge capacity of 18,000 gpm (40 cu. ft. per sec.) and are designed to pump the runoff from a rainfall of 1 1/2 inches per hour.

The two 36-inch sump gates are normally closed and the 48 inch sluice gate is normally fully open. When the pumping station is activated, the sump gates, located in front of each pump, are manually opened with a handcrank. It takes about 15 minutes to open each sump gate. The 48-inch gate is manually closed in about 20 minutes.

## 15. SEWER GATES

There are two gravity flow sewer lines which also pass through the dike. During flood periods, the sanitary sewage continues to flow by gravity, and no operational procedures are necessary.

Gate valves have been installed on both the 16-inch and 4-inch lines. These valves, normally fully open, are located in the general vicinity of the Block House. In the unlikely event that a rupture or break occurs in the lower end of either sewer line, and floodwaters from the river begin to back up into the landside area of the dike, the sewer gate will be immediately closed and remain closed until the floodwaters recede. Refer to sheet 13 of the as-built drawings for locations of the gate valves.

## 16. PRESSURE CONDUIT

The runoff from the high level watershed automatically flows into the St. John River and no operations are required.

A sluice gate has been constructed in the pressure conduit, and it is located on the riverside of the dike about 500 feet upstream of the International Bridge. This gate is normally fully open. In the unlikely event that a rupture or break occurs in the lower end of the pressure conduit, and floodwaters from the river begin to back up into the landside area of the dike, the gate will be immediately closed (20 minutes), and remain closed until the floodwaters recede.

## OPERATIONAL CONSIDERATIONS

### 17. GENERAL

Factors that must be considered in the operation of this project are:

a. National Weather Service Forecasts of possible flooding in the Fort Kent area.

b. The time needed by the Superintendent to mobilize personnel associated with operation of the project.

- c. Activation time required at the pumping station.
- d. Observations along the dikes and conduits during high flows to detect leaks, obstructions or problem areas.
- e. The possibility of placing sandbags along the Block House roadway during a major flood (refer to paragraph 20).

## 18. MOBILIZATION

The actual time required to mobilize personnel and activate the pumping station for a flood is dependent on many items and presently can only be estimated. In order to provide sufficient time to overcome unforeseeable personnel, weather or mechanical difficulties, mobilization and staffing will begin when a rising river stage reaches 14 feet at the pumping station or at the Saint John River gage (TELEMARK).

### OPERATIONAL PHASES AND INSTRUCTIONS FOR FLOODS

## 19. OPERATIONAL PHASES

The Project Superintendent should be watchful beginning in April for warm days with rainfall which could start the spring runoff period. The operational functions have been divided into 'phases' to assure a clear delineation of actions to be taken prior to and during flood conditions and are outlined below:

Phase 1 - Project Superintendent alerts crew of possible flood.

Phase 2 - Begin staffing operations.

Phase 3 - Begin flood operations

Phase 4 - Cessation

For sample flood operations refer to plate B-3.

## 20. INSTRUCTIONS

This section contains instructions to be followed by personnel operating the project during flood periods. The instructions have been summarized and are shown on plates B-1 and B-2. A telephone directory is included on plate B-7.

a. Phase 1. The National Weather Service issues a "flood watch" for the Saint John River. The superintendent will alert his crew and commence recording river stages at least twice a day. Phase 1 may also be initiated for: (1) melting snow with warm temperatures; (2) river ice starting to break up causing ice jams; (3) river level reaches 10 feet and is rising and; (4) information from the Corps of Engineers indicating possible high riverflows might occur at Fort Kent. During this phase the river level indicator gage in the pumping station will be checked with the metal staff gage reading and adjusted if necessary.

b. Phase 2. Begin staffing operations at the pumping station when any of the following conditions develop:

(1) A "flood warning" has been issued by the National Weather Service for the Saint John River.

(2) The Saint John River level at the Fort Kent gage (Telemark gage) or the pumping station reaches 14 feet and is still rising.

c. Phase 3. Activate the pumping station when the rising river level reaches a stage of 16 feet. Open the sump gates and if interior runoff is occurring from rainfall or snowmelt then start the pumps, close the 48-inch gravity conduit gate and operate in accordance with the schedule on plate B-2. These procedures may have to overlap if a high rate of interior runoff is occurring.

d. Phase 4. When the river level recedes to a stage of 15 feet and is expected to continue falling, deactivate the pumping station in accordance with schedule on plate B-2.

At the completion of phase 4, the operation will revert to phase 1 until the river level falls below a 12-foot stage.

## 21. BLOCK HOUSE ROADWAY

It is noted that along the Fish River entrance road to the "Block House" and up to the concrete cut off wall beside the lumber yard entrance there is no freeboard protection. This is because the additional three feet in this reach would spoil the appearance and scenic value of the "Block House", a national historical landmark. Therefore it will be necessary to sandbag this reach during the unusual occurrence of major flood of the project design level. This will require approximately 700 feet (station 35 + 40 to the south side of Main St.) of sandbagging up to three feet high. Sandbags and dry sand must therefore be stored in an easily accessible location for use during major flood events.

## 22. WATER LEVEL GAGES AT THE PUMPING STATION

a) Staff Gage. A metal staff gage is located on the inside wall of the sluice gate structure near the pumping station. This gage, which reads from 8.6 feet to over 30 feet, was installed so that the river stage reading at the staff gage would correspond to a similar river stage reading at the Fort Kent telemark gage. (i.e. - an 18 foot reading on the staff gage would be about an 18 foot reading at the Telemark)

b) Circular Gages - River Level and Sump Level. When it is necessary to operate the pumps to discharge runoff from the low level area into the St. John River, the operator must continually monitor both the river level and the sump level. Therefore two circular indicator gages have been installed in the pump station to indicate the level of the water in the St. John River and the depth of water in the sump. Both gages should be periodically calibrated to insure accurate stage readings.

## 23. REPORTS

Prior to and during the operation of the project, information pertinent to a flood operation will be entered in a log of reports (plate B-4). The flood report will include gate openings and closings, pumping operations, river levels, sump levels, and any problems or observations that would help in evaluating the operational procedures and prescribed regulations. A copy of flood reports will be mailed to RCC within one week after completion of an operation:

New England Division Corps of Engineers  
c/o Reservoir Control Center  
424 Trapelo Road  
Waltham, Massachusetts 02154

STANDARD OPERATING PROCEDURES  
FORT KENT LOCAL PROTECTION PROJECT

<u>PHASE</u>		<u>CONDITION</u>	<u>PERSONNEL</u>	<u>PUMPING STATION</u>	
				<u>GATES</u>	<u>PUMPS</u>
Normal			Inactive	Gravity Conduit - Open Sump - Closed	Idle
1	ALERTING	a) National Weather Service issues a flood "watch" for the Saint John River b) Melting snow with warm temperatures c) River ice causing significant ice jams d) River stage reaches 10 feet and rising e) Information from the Corps of Engineers indicates high river flows might occur at Fort Kent	All personnel will be alerted	Normal	Idle
2	STAFFING	a) NWS issues a "flood warning" for Saint John River b) River stage reaches 14 feet and rising	Staff pumping station	Normal	Idle
3	OPERATION	River stage reaches 16 feet and rising	a) Activate the pumping station b) Observe dike and conduits to detect leaks, obstructions or problem areas	a) Open sump gates b) Close gravity conduit gate	Operate by schedule (See plate B-2)
4	CESSATION	Stage recedes to 15 feet and falling	Deactivate pumping station	a) Open gravity conduit gate b) Close sump gates	Stop by schedule (See plate B-2)
1		Phase 1 to remain in effect until the river level recedes to 12 feet	All personnel remain on ALERT status	Normal	Idle

NOTES: 1) Sluice gate #1, the 16" sewer gate or 4" sewer gate will be closed if a conduit rupture occurs, and river water is backing up into the protected areas (refer to par. 14).  
2) Refer to par. 20 concerning the sandbagging of Block House Road.

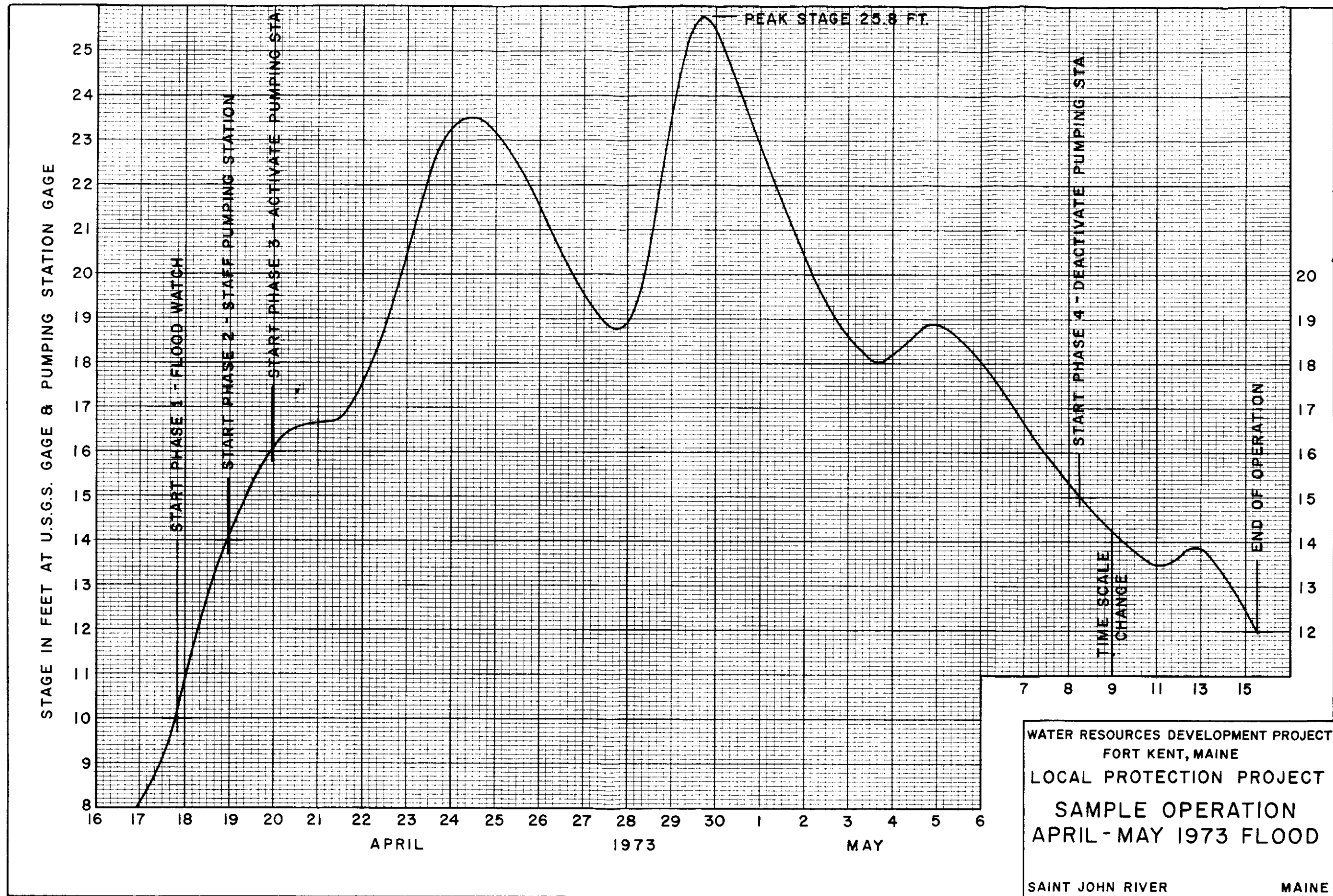


FORT KENT PUMPING STATION  
OPERATING SCHEDULE

<u>Normal Conditions</u>	<u>FLOOD OPERATIONS</u>												
	<u>Activate Station</u>	<u>Pump Operations</u>	<u>Deactivate Station</u>										
During nonflood times the station will be in the following status:	When the water rises to 16 feet on the river level gage the operator will:	Operate pump(s) based on the following water levels in the sump, and alternate the starting of pumps:	When the river stage recedes to 15 feet the operator will:										
1. 48" gravity conduit gate open	1. Shut off automatic sump pump	<table><tr><th colspan="2"><u>Pumps</u></th></tr><tr><th><u>No. 1</u></th><th><u>No. 2</u></th></tr><tr><td colspan="2">(sump level in feet)</td></tr><tr><td>start 7</td><td>7-1/2</td></tr><tr><td>stop 3*</td><td>3*</td></tr></table>	<u>Pumps</u>		<u>No. 1</u>	<u>No. 2</u>	(sump level in feet)		start 7	7-1/2	stop 3*	3*	1. Open the gravity conduit gate
<u>Pumps</u>													
<u>No. 1</u>	<u>No. 2</u>												
(sump level in feet)													
start 7	7-1/2												
stop 3*	3*												
2. Both sump gates closed	2. Open 36" sump gates		2. Close sump gates										
3. Automatic sump pump on	3. Close 48" gravity conduit gate and start pumps, operating by schedule.		3. Turn on automatic sump pump										
			4. Complete station log										

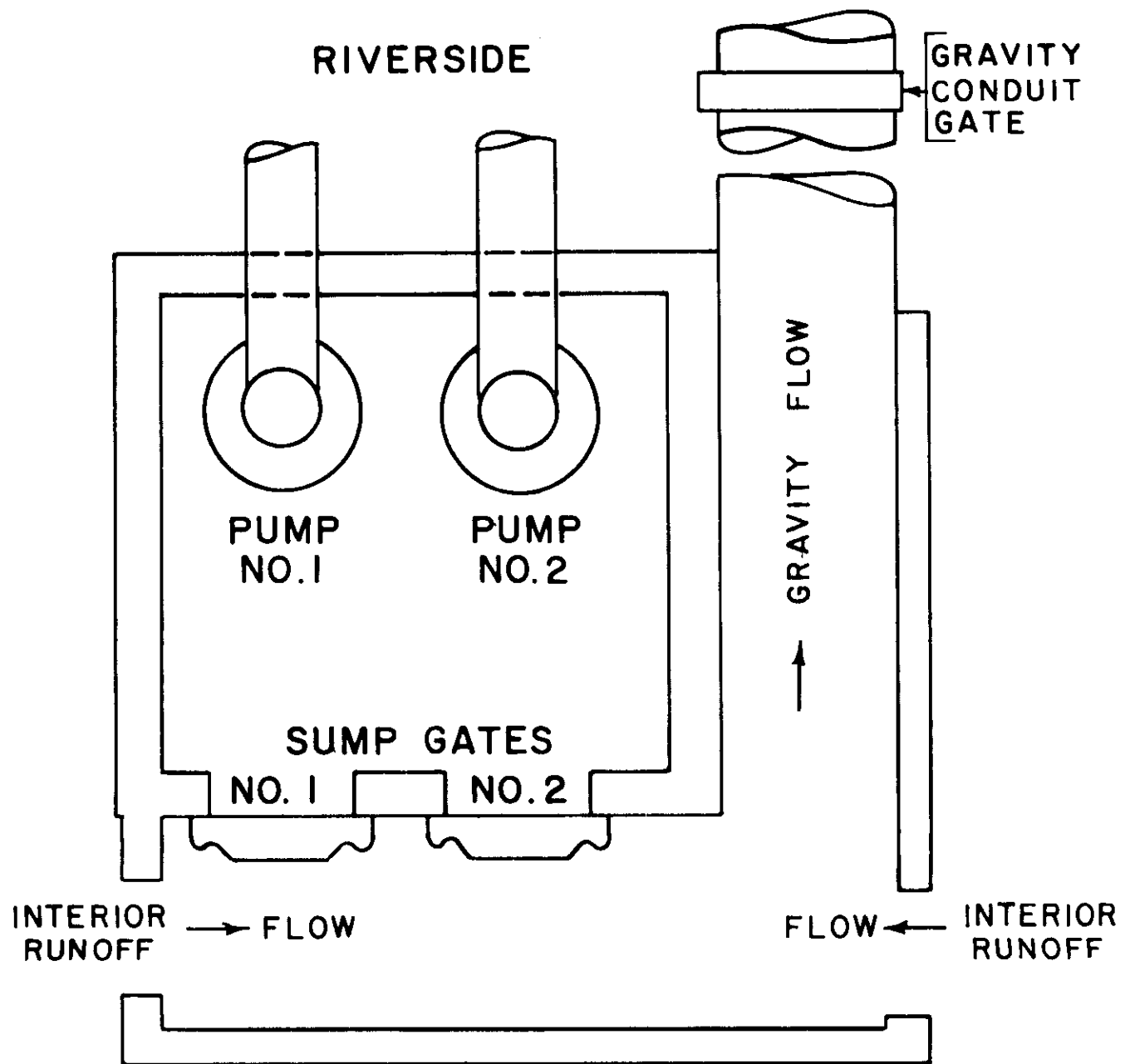
\*NOTE: a) The water level indicator is designed to automatically sound an alarm when the water level drops to a stage of 3 feet in the sump, and automatically shut off the pumps when the level drops to 2 feet.

b) The steel rod float stop is 1 foot above the floor of the sump; therefore the gage dial should indicate a 1 foot reading when the float is resting on the rod.

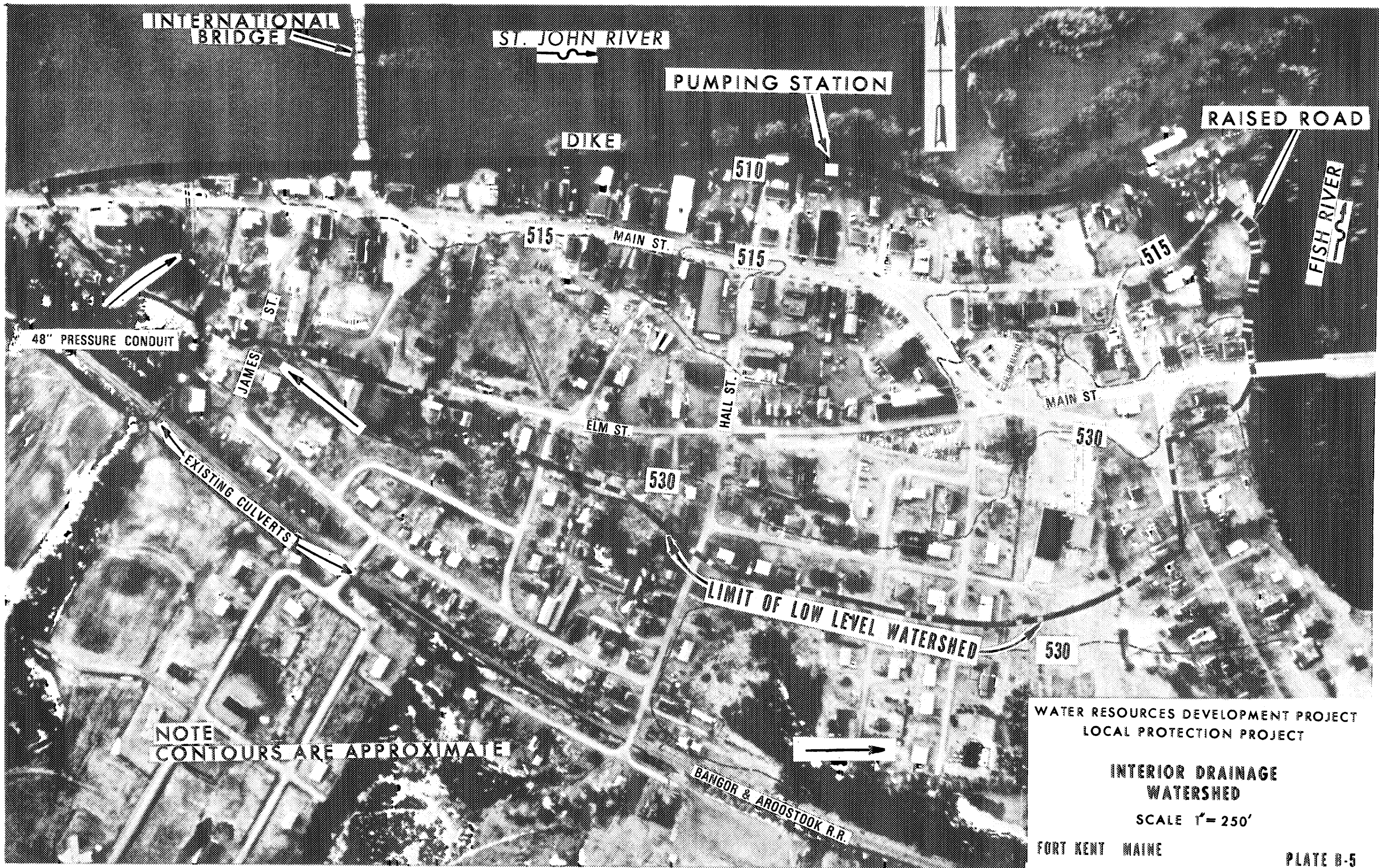


# FORT KENT PUMPING STATION

## OPERATION LOG

[illegible]





WATER RESOURCES DEVELOPMENT PROJECT  
LOCAL PROTECTION PROJECT

INTERIOR DRAINAGE  
WATERSHED

SCALE 1" = 250'

FORT KENT MAINE

PLATE B-5

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)Sta. No. 0 1-0 1 1 0 0Table No. 0 8Begin 6 8 0 4 1 8  
YR. MO. D. HR.Rating table for St. John River at Fort Kent, Mainefrom to, from April 18, 68 to, from to

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
0.00			2.00	1,750	100	4.00	4,400	170	6.00	8,750	260	8.00	14,500	300	10.00	21,700	400	12.00	30,500	500
.10			.10	1,850	100	.10	4,570	180	.10	9,010	270	.10	14,800		.10	22,100		.10	31,000	
.20			.20	1,950	110	.20	4,750	180	.20	9,280	270	.20	15,100		.20	22,500		.20	31,500	
.30			.30	2,060	110	.30	4,930	190	.30	9,550	270	.30	15,400		.30	22,900		.30	32,000	
.40			.40	2,170	110	.40	5,120	190	.40	9,820	280	.40	15,700		.40	23,300		.40	32,500	
.50	450	77	.50	2,280	120	.50	5,310	200	.50	10,100	300	.50	16,000	300	.50	23,700		.50	33,000	
.60	527	77	.60	2,400	120	.60	5,510	200	.60	10,400	300	.60	16,300	400	.60	24,100		.60	33,500	
.70	604	78	.70	2,520	120	.70	5,710	210	.70	10,700	200	.70	16,700	300	.70	24,500		.70	34,000	
.80	682	80	.80	2,640	130	.80	5,920	210	.80	10,900	300	.80	17,000	400	.80	24,900		.80	34,500	
.90	760	85	.90	2,770	130	.90	6,130	220	.90	11,200		.90	17,400	300	.90	25,300		.90	35,000	
1.00	840	85	3.00	2,900	130	5.00	6,350	220	7.00	11,500		9.00	17,700	400	11.00	25,700		13.00	35,500	
.10	925	90	.10	3,030	140	.10	6,570	220	.10	11,800		.10	18,100		.10	26,100	400	.10	36,000	
.20	1,010		.20	3,170	140	.20	6,790	230	.20	12,100		.20	18,500		.20	26,500	500	.20	36,500	
.30	1,100		.30	3,310	140	.30	7,020	230	.30	12,400		.30	18,900		.30	27,000		.30	37,000	
.40	1,190		.40	3,450	150	.40	7,250	240	.40	12,700		.40	19,300		.40	27,500		.40	37,500	500
.50	1,280		.50	3,600	150	.50	7,490	240	.50	13,000		.50	19,700		.50	28,000		.50	38,000	600
.60	1,370		.60	3,750	160	.60	7,730	250	.60	13,300		.60	20,100		.60	28,500		.60	38,600	
.70	1,460	90	.70	3,910	160	.70	7,980	250	.70	13,600		.70	20,500		.70	29,000		.70	39,200	
.80	1,550	100	.80	4,070	160	.80	8,230	260	.80	13,900		.80	20,900		.80	29,500		.80	39,800	
.90	1,650	100	.90	4,230	170	.90	8,490	260	.90	14,200	300	.90	21,300	400	.90	30,000	500	.90	40,400	600

This table is applicable for open-channel conditions. It is based on \_\_\_\_\_ discharge measurements made during \_\_\_\_\_

\_\_\_\_\_ and is \_\_\_\_\_ well defined between \_\_\_\_\_ cfs and \_\_\_\_\_ cfs.

Comp. by \_\_\_\_\_ date \_\_\_\_\_

Ckd. by \_\_\_\_\_ date \_\_\_\_\_



UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 01-014 00

Table No. 08

Begin 680418  
YR. MO. D HR.

Rating table for St. John River at Fort Kent, Maine

from to , from April 18, 1968 to

, from to

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
14.00	41,000	6.00	16.00	53,000	7.00	18.00	67,000	8.00	20.00	83,000	6.00	22.00	99,000	1,000	24.00	118,000	1,000	26.00		
.10	41,600		.10	53,700		.10	67,800		.10	83,800		.10	100,000		.10	119,000		.10		
.20	42,200		.20	54,400		.20	68,600		.20	84,600		.20	101,000		.20	120,000		.20		
.30	42,800		.30	55,100		.30	69,400		.30	85,400		.30	102,000		.30	121,000		.30		
.40	43,400		.40	55,800		.40	70,200		.40	86,200		.40	103,000	1,000	.40	122,000		.40		
.50	44,000		.50	56,500		.50	71,000		.50	87,000		.50	104,000	0	.50	123,000		.50		
.60	44,600		.60	57,200		.60	71,800		.60	87,800		.60	104,000	1,000	.60	124,000		.60		
.70	45,200		.70	57,900		.70	72,600		.70	88,600		.70	105,000		.70	125,000		.70		
.80	45,800		.80	58,600		.80	73,400		.80	89,400		.80	106,000		.80	126,000		.80		
.90	46,400		.90	59,300		.90	74,200		.90	90,200		.90	107,000		.90	127,000		.90		
15.00	47,000		17.00	60,000		19.00	75,000		21.00	91,000		23.00	108,000		25.00	128,000				
.10	47,600		.10	60,700		.10	75,800		.10	91,800		.10	109,000		.10	129,000		.10		
.20	48,200		.20	61,400		.20	76,600		.20	92,600		.20	110,000		.20	130,000		.20		
.30	48,800		.30	62,100		.30	77,400		.30	93,400		.30	111,000		.30	131,000		.30		
.40	49,400		.40	62,800		.40	78,200		.40	94,200		.40	112,000		.40	132,000		.40		
.50	50,000		.50	63,500		.50	79,000		.50	95,000		.50	113,000		.50	133,000	1,000	.50		
.60	50,600		.60	64,200		.60	79,800		.60	95,800		.60	114,000		.60	134,000		.60		
.70	51,200		.70	64,900		.70	80,600		.70	96,600		.70	115,000		.70			.70		
.80	51,800		.80	65,600		.80	81,400		.80	97,400		.80	116,000		.80			.80		
.90	52,400	6.00	.90	66,300	7.00	.90	82,200	8.00	.90	98,200	8.00	.90	117,000	1,000	.90			.90		

PLATE B-6

This table is applicable for open-channel conditions. It is based on \_\_\_\_\_ discharge measurements made during \_\_\_\_\_  
and is \_\_\_\_\_ well defined between \_\_\_\_\_ cfs and \_\_\_\_\_ cfs.

Comp. by \_\_\_\_\_ date \_\_\_\_\_

Ckd. by \_\_\_\_\_ date \_\_\_\_\_

TELEPHONE DIRECTORY  
(November 1977)

<u>1. TOWN OF FORT KENT</u>	<u>NUMBER</u>
USGS Telemark Gage at Fort Kent	834-3605
Project Superintendent, Alberie Nadeau	(office) 834-3463 (home) 834-5270
Police Department	834-5678
Road Crew Foreman, Clarence Blier	(office) 834-3253 (home) 834-5975
Town Manager, Claude Dumond	834-3090
<u>2. NATIONAL WEATHER SERVICE</u>	
District Forecaster - Portland, Maine	207-755-3552
<u>3. CORPS OF ENGINEERS</u>	
a) <u>Reservoir Control Center - Waltham, Mass.</u>	
Office Hours*	617-894-2400, X630
Nonoffice Hours**	617-894-2414, 2415
b) <u>Operations Division - Waltham, Mass.</u>	
Office Hours*	617-894-2400, X320
Nonoffice Hours**	617-894-2412
c) Al Sawicki - Franklin, N. H.	603-934-2116 603-934-2673

\* Monday through Friday, 0800 to 1630 hours

\*\* Nights, holidays and weekends when telephone switchboard is  
not serviced.

APPENDIX C

INSPECTION REPORT FORMS

Standard Letter to Superintendent of  
Local Flood Protection System  
With Three Exhibits





DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO  
NEDOD-R

TO: Superintendent, Local Flood Protection System

REFERENCE: Code of Federal Regulations, Title 33, Section 208.10 (a) (6),  
Local Flood Protection Works

Assurances given by local cooperating agencies prior to construction of Local Protection Projects require the submission of a semi-annual report to the Division Engineer. As "Superintendent" of your project this becomes your responsibility. This brochure is intended to help you in preparing your reports.

We hope that you do not have the misconception that these reports are valueless, for they serve a definite and useful purpose. Statistical information derived from these reports is invaluable for future design and also for evaluating effectiveness of the present protection system. The semi-annual reports, when properly submitted, provide information on conditions that often indicate the necessity for changes or modification to the existing system. In short, they help us to determine whether the project is doing the job for which it was built.

Attached are samples of good reports which might help you in preparing yours.

Exhibit "A" is the semi-annual report. It is submitted in letter form. Basically it covers the five (5) specific areas of information required in the "Reports" paragraph of the standard project O&M Manual. It should be brief but complete. Negative replies to outline paragraphs should be submitted, if applicable.

Exhibits "B" and "C" are the 90-day interim reports required as attachments to the semi-annual report. Additional reports of conditions "before" and "after" floods should also be attached when applicable.

If you have any difficulties at all in preparing your reports, please don't hesitate to talk it over with our people during their visits to your project.



# TOWN OF WEST SPRINGFIELD, MASSACHUSETTS ENGINEERING DEPT.

INCLUDING STREETS, SEWERS, DIKES, ASH COLLECTIONS AND SIDEWALKS

WALLACE W. WYMAN  
TOWN ENGINEER  
JOHN J. BRENNAN  
ASST. SUPT. OF STREETS  
ARTHUR F. BINGHAM  
ASST. TOWN ENGINEER

TEL. RE 3-7831  
EXT. 37, 42, 44, 55

HOURS:  
YARD: 7 A.M. - 4 P.M.  
OFFICE: 8:30 A.M. - 5 P.M.

September 8, 1964

Division Engineer  
U. S. Army Engineers  
New England Division  
484 Trapelo Road  
Waltham, Mass. 02154

Re: Semi-annual Dike Inspection Report on West Springfield Dikes

Dear Sirs:

As required by your regulations I wish to report that the following maintenance work has been performed during the past six months:

All sodded dikes have been mowed and raked at regular intervals. Eroded portions of the surface have been repaired with loam and seed. Weeds in the rip-rapped areas have been sprayed with a weed killing spray. All dikes have been patrolled and checked at regular intervals. The vitrified clay pipes at the tops of all relief wells at the toe of the Riverdale Dike have been cleaned, repaired or replaced, as necessary.

We use a permanent crew of one foreman, one equipment operator and one maintenance man augmented by two or three laborers during the summer months.

A request for bids on the replacement of the first engine in the Warren Street pumping station is being advertised this month. We are requesting some quotations on exterior waterproofing of the older stations and will do as much as we can with the available funds. Three mufflers need repairs to the muffler or insulation jacket. This will be done.

All engines are started and test operated once a week. All stations have had resistance tests made during the summer.

EXHIBIT A

There have been nothing but compliments made regarding the maintenance and operation of the dike system. The Town Meeting has never refused any legitimate request for funds for repair or operation.

Very truly yours,

/s/ Wallace W. Wyman

WW:ick

2 Incls:

1. Interim Inspection Report dtd. 6 May 1964
2. Interim Inspection Report dtd. 27 Aug. 1964

# LOCAL FLOOD PROTECTION PROJECT INSPECTION REPORT

Project: West Springfield Dike System

Maintaining Agency: Town of West Springfield, Massachusetts

Type Inspection: \_\_\_\_\_ Semi-Annual Staff X 90 Day Interim

River Basin: Connecticut River

Date of Inspection: May 1964

Feature	Sat	Unsat	Deficiencies
---------	-----	-------	--------------

## PUMPING STATIONS - STRUCTURES

INTERIOR	X		
EXTERIOR	X		waterproofing of walls to be scheduled.

## PUMPS - MOTORS - ENGINES

TRIAL OPERATED	X		
GENERAL CONDITION	X		Pump Engine Replacement Program has been
POWER SOURCE	X		initiated.
INSULATION TESTS	X		Insulation tests required.
METAL INTAKES/OUTLETS	X		
GATE VALVES	X		

## GATES - DRAINAGE STRUCTURES

TRIAL OPERATED	X		See Remarks
GENERAL CONDITION	X		
LUBRICATION	X		

## DIKES - DAMS

GENERAL CONDITION	X		
SLOPES/EROSION	X		
SAND BOILS/CAVING	X		
TRESPASSING	X		Dikes in need of barriers to prevent access.
SLOPE PROTECTION	X		
DRAINS	X		

## STOP-LOGS - LOG BOOM

CONDITION OF LOGS	X		
AVAILABILITY OF LOGS	X		
HIGHWAY SLOTS	X		See Remarks
STORAGE FACILITIES	X		See Remarks

## CHANNELS - OUTLET WORKS CHANNEL - Not Applicable

OBSTRUCTIONS			
OBSTRUCTION CONTROL			

Feature	Sat	Unsat	Deficiencies
<b>CONCRETE STRUCTURES</b>			
SURFACE	X		
SETTLEMENT	X		
JOINTS	X		
DRAINS	X		

<b>MISCELLANEOUS</b>			
EMERGENCY OPER. PLAN	X		
EMERGENCY EQUIPMENT	X		
SEMI-ANNUAL REPORT	X		
CONDUITS	X		
FLAP VALVES	X		

**Inspection Party:**

Wallace W. Wyman, Town Engineer, West Springfield, Mass.

**Photographs Taken:**

None Required

**Remarks & Additional Comments:**

( Indicate Here Observations, Discussions, Specific Feature Deficiencies, Recommendations and any other pertinent information. Use Continuation Sheet if necessary. )

GATES: Gates were not operated during inspection. Riverdale, Bridge Street and Circuit Avenue stations were in operation during river flood stages in April.

HIGHWAY SLOTS: Two Highway Slot Frames need minor repair and resetting.

STORAGE FACILITIES: Vertical cracking in storage structure evident. Need re-jointing.

X ALL APPLICABLE ITEMS IF UNSAT INDICATE SPECIFIC DEFICIENCIES. INDICATE IF NOT APPLICABLE.

DATE	INSPECTED BY: TYPED NAME & TITLE	SIGNATURE
5 May 1964	Wallace W. Wyman, Town Engineer	/s/ Wallace W. Wyman

# LOCAL FLOOD PROTECTION PROJECT INSPECTION REPORT

Project: West Springfield Dike System

Maintaining Agency: Town of West Springfield, Massachusetts

Type Inspection: \_\_\_\_\_ Semi-Annual Staff X 90 Day Interim

River Basin: Connecticut River

Date of Inspection 27 August 1964

Feature	Sat	Unsat	Deficiencies
<b>PUMPING STATIONS - STRUCTURES</b>			
INTERIOR	X		
EXTERIOR	X		Walls to be waterproofed next month.
<b>PUMPS - MOTORS - ENGINES</b>			
TRIAL OPERATED	X		
GENERAL CONDITION	X		Three mufflers need repairs.
POWER SOURCE	X		
INSULATION TESTS	X		To be made next month.
METAL INTAKES/OUTLETS	X		
GATE VALVES	X		
<b>GATES - DRAINAGE STRUCTURES</b>			
TRIAL OPERATED	X		
GENERAL CONDITION	X		
LUBRICATION	X		
<b>DIKES - DAMS</b>			
GENERAL CONDITION	X		
SLOPES/EROSION	X		
SAND BOILS/CAVING	X		None Found
TRESPASSING	X		
SLOPE PROTECTION	X		
DRAINS	X		Repairs made this summer.
<b>STOP-LOGS - LOG BOOM</b>			
CONDITION OF LOGS	X		
AVAILABILITY OF LOGS	X		
HIGHWAY SLOTS	X		
STORAGE FACILITIES	X		Walls to be waterproofed.
<b>CHANNELS - OUTLET WORKS CHANNEL - Not Applicable</b>			
BANKS			
OBSTRUCTION CONTROL			

Feature	Sat	Unsat	Deficiencies
<b>CONCRETE STRUCTURES</b>			
SURFACE	X		
SETTLEMENT	X		
JOINTS	X		
DRAINS	X		
<b>MISCELLANEOUS</b>			
EMERGENCY OPER. PLAN	X		
EMERGENCY EQUIPMENT	X		
SEMI-ANNUAL REPORT	X		
CONDUITS	X		
FLAP VALVES	X		
<b>Inspection Party:</b> <p>Wallace W. Wyman, Town Engineer, West Springfield, Mass.</p>			
<b>Photographs Taken:</b> <p>None Required</p>			
<b>Remarks &amp; Additional Comments:</b> <p>( Indicate Here Observations, Discussions, Specific Feature Deficiencies, Recommendations and any other pertinent information. Use Continuation Sheet if necessary. )</p>			
<small>ALL APPLICABLE ITEMS. IF UNSAT INDICATE SPECIFIC DEFICIENCIES. INDICATE IF NOT APPLICABLE.</small>			
DATE	INSPECTED BY: TYPED NAME & TITLE		SIGNATURE
27 Aug 1964	Wallace W. Wyman, Town Engineer		/s/ Wallace W. Wyman

# LOCAL FLOOD PROTECTION PROJECT INSPECTION REPORT

Project:

Maintaining Agency:

Type Inspection: \_\_\_\_\_ Semi-Annual Staff \_\_\_\_\_ 90 Day Interim

River Basin: \_\_\_\_\_ Date of Inspection \_\_\_\_\_

Feature	Sat	Unsat	Deficiencies
<b>PUMPING STATIONS - STRUCTURES</b>			
INTERIOR			
EXTERIOR			
<b>PUMPS - MOTORS - ENGINES</b>			
TRIAL OPERATED			
GENERAL CONDITION			
POWER SOURCE			
INSULATION TESTS			
METAL INTAKES/OUTLETS			
GATE VALVES			
<b>GATES - DRAINAGE STRUCTURES</b>			
TRIAL OPERATED			
GENERAL CONDITION			
LUBRICATION			
<b>DIKES - DAMS</b>			
GENERAL CONDITION			
SLOPES/EROSION			
SAND BOILS/CAVING			
TRESPASSING			
SLOPE PROTECTION			
DRAINS			
<b>STOP-LOGS - LOG BOOM</b>			
CONDITION OF LOGS			
AVAILABILITY OF LOGS			
HIGHWAY SLOTS			
STORAGE FACILITIES			
<b>CHANNELS - OUTLET WORKS CHANNEL</b>			
BANKS			
OBSTRUCTION CONTROL			



Feature	Sat	Unsat	Deficiencies
<b>CONCRETE STRUCTURES</b>			
SURFACE			
SETTLEMENT			
JOINTS			
DRAINS			
<b>MISCELLANEOUS</b>			
EMERGENCY OPER. PLAN			
EMERGENCY EQUIPMENT			
SEMI-ANNUAL REPORT			
<b>Inspection Party:</b>  			
<b>Photographs Taken:</b>  			
<b>Remarks &amp; Additional Comments:</b> ( Indicate Here Observations, Discussions, Specific Feature Deficiencies, Recommendations and any other pertinent information. Use Continuation Sheet if necessary. )  			
X ALL APPLICABLE ITEMS. IF UNSAT INDICATE SPECIFIC DEFICIENCIES. INDICATE IF NOT APPLICABLE.			
DATE	INSPECTED BY: TYPED NAME & TITLE		SIGNATURE

APPENDIX D

ASSURANCES OF LOCAL COOPERATION

TOWN OF FORT KENT  
AND  
STATE OF MAINE

AGREEMENT BETWEEN  
THE UNITED STATES OF AMERICA  
AND  
THE STATE OF MAINE  
FOR LOCAL COOPERATION AT  
THE FORT KENT LOCAL FLOOD PROTECTION PROJECT  
ST. JOHN RIVER, FORT KENT, MAINE

THIS AGREEMENT entered into this 30th day of January,  
19 76 by and between the UNITED STATES OF AMERICA (hereinafter called  
the "Government"), represented by the Contracting Officer executing this  
agreement, and the STATE OF MAINE (hereinafter called the "State"), acting  
by and through its Executive Council, WITNESSETH THAT:

WHEREAS, construction of the flood protection project on the  
St. John River, Fort Kent, Maine, providing for the construction of 3245  
linear feet of earth fill dike with stone slope protection, starting approximately  
1000 feet upstream of the International Bridge and ending near the Fort Kent  
Blockhouse, a pumping station and interior drainage facilities to collect and  
discharge the drainage of 62 acres of developed land behind the protection works,  
a 48-inch pressure conduit to discharge runoff from the hills at the upstream edge  
of the project, and about 550 linear feet of raised roadway at Blockhouse Road,  
extending along the Fish River from Main Street to the Blockhouse (hereinafter  
called the "Project"), was approved by the Chief of Engineers on 3 September  
1975 under authority granted by Section 205 of the 1948 Flood Control Act, as

amended by Section 61 of the Water Resources Development Act of 1974, Public Law 93-251, approved 7 March 1974 (33 USCA 701s); and

WHEREAS, the State hereby represents that it has the authority and capability to furnish the non-Federal cooperation required by the Federal legislation authorizing the Project and by other applicable law.

NOW, THEREFORE, the parties agree as follows:

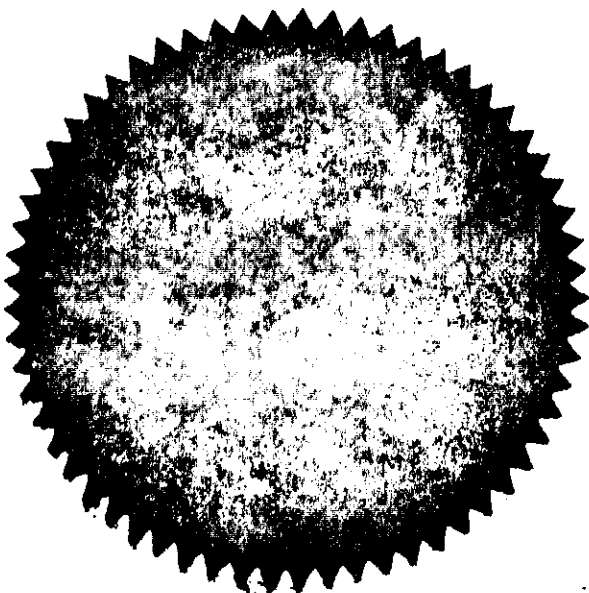
1. The State agrees that, if the Government shall commence construction of the local flood protection project on the St. John River, Fort Kent, Maine, substantially in accordance with the approval of the Chief of Engineers under Section 205 of the 1948 Flood Control Act, as amended, the State shall, in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation, to wit:
  - a. Hold and save the Government free from damages due to the construction works, except where such damages are due to the fault of the United States or its contractors.
2. This Agreement is subject to the approval of the Secretary of the Army.

CERTIFICATION

I, Markham L. Gortley, certify that I am the  
Secretary of the State of Maine; that James B. Longley,  
who signed this Agreement on behalf of the State of Maine, was Governor of  
the State; that Charles A. Jacobs, Carl E. Cianchette,  
David E. Redmond, Charles H. Abbott,  
Richard S. Webber, Nathan Cohen,  
and John F. Clemente were members of the Executive Council  
on the date of execution and approval of this Agreement, and that \_\_\_\_\_  
Joseph E. Brennan was Attorney General.

IN WITNESS WHEREOF, I have herewith affixed my hand and seal and  
the seal of the State of Maine, this 15th day of October,  
1975.


Markham L. Gortley  
Secretary of State



(State Seal)

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.


THE UNITED STATES OF AMERICA    THE STATE OF MAINE

By   
JOHN H. MASON  
Colonel, Corps of Engineers  
Division Engineer  
Contracting Officer

By   
JAMES B. LONGLEY, Governor


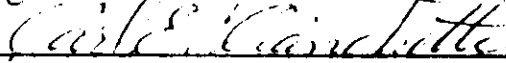
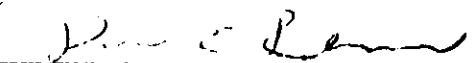
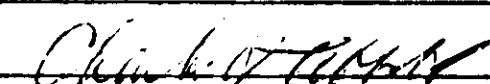
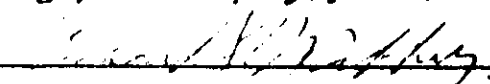


DATE: 30 January 1976

APPROVED:

  
E. COWEN  
Acting Director of Real Estate

For THE Secretary of the Army

APPROVED BY:

  
  
  
  
  
  
  
Executive Council

I have reviewed the foregoing Agreement and have considered the effect of Section 221 of the Flood Control Act of 1970, Public Law 91-611, and I am satisfied that the State can fully comply with the provisions of said Agreement. Accordingly, I approve the foregoing Agreement.

  
Attorney General

KNOW ALL MEN BY THESE PRESENTS

That the TOWN OF FORT KENT hereby grants to the UNITED STATES OF AMERICA, its agents, employees, and contractors permission to enter upon all the lands needed for construction and maintenance of the local flood protection project on the St. John River, Fort Kent, Maine, which was approved by the Chief of Engineers on 3 September 1975 under authority granted by Section 205 of the 1948 Flood Control Act, as amended by Section 61 of the Water Resources Development Act of 1974, Public Law 93-25, approved 7 March 1974 (33 USCA 701s).

The purpose of the right-of-entry is to permit the construction of 3245 linear feet of earth fill dike with stone slope protection starting approximately 1000 feet upstream of the International Bridge and ending near the Fort Kent Blockhouse, a pumping station, interior drainage facilities, and a 48-inch pressure conduit.

IN WITNESS WHEREOF, on this 22 day of March, 1976, the said TOWN OF FORT KENT has caused this instrument to be executed and delivered and its seal to be hereunto affixed by Carlton J. Savage, Chairman of the Town Council, hereunto duly authorized and empowered.

TOWN OF FORT KENT

By Carlton J. Savage  
CARLTON A. SAVAGE, CHAIRMAN

State of Maine,            )  
                                  ) ss: Fort Kent  
County of Aroostook.)

In Fort Kent on the 22 day of March, 1976,  
before me personally appeared Carlton J. Savage, Chairman of the  
Town Council of the Town of Fort Kent, Aroostook County, State of  
Maine, to me known and known by me as the party executing the  
foregoing instrument, and he acknowledged said instrument by him  
executed to be his free act and deed as said Chairman, and the free  
act and deed of the Town of Fort Kent.

*Clement J. Fairbairn*

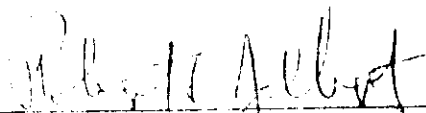
Notary Public

My commission expires 10 - 4 - 1977



# ATTORNEY'S CERTIFICATE

I hereby certify that the Town of Fort Kent has valid and assignable real estate rights and interests in and to all the premises needed for construction and maintenance of the local flood protection project as approved by the Chief of Engineers on 3 September 1975 under authority granted by Section 205 of the 1948 Flood Control Act, as amended by Section 61 of the Water Resources Development Act of 1974, Public Law 93-251, approved 7 March 1974 (33 USCA 701s).



Robert L. Jalbert  
Town Counsel

AGREEMENT BETWEEN  
THE UNITED STATES OF AMERICA  
AND  
TOWN OF FORT KENT  
FOR LOCAL COOPERATION AT  
THE FORT KENT LOCAL FLOOD PROTECTION PROJECT  
ST. JOHN RIVER, FORT KENT, MAINE

THIS AGREEMENT entered into this 26<sup>th</sup> day of January, 19 76, by and between the UNITED STATES OF AMERICA (hereinafter called the "Government"), represented by the Contracting Officer executing this agreement, and the TOWN OF FORT KENT (hereinafter called the "Town"), acting by and through its Town Council, WITNESSETH THAT:

WHEREAS, construction of the Fort Kent Local Flood Protection Project on the St. John River, Fort Kent, Maine, providing for the construction of 3245 linear feet of earth fill dike with stone slope protection, starting approximately 1000 feet upstream of the International Bridge and ending near the Fort Kent Blockhouse, a pumping station and interior drainage facilities to collect and discharge the drainage of 62 acres of developed land behind the protection works, a 48-inch pressure conduit to discharge runoff from the hills at the upstream edge of the Project, and about 550 linear feet of raised roadway at Blockhouse Road, extending along the Fish River from Main Street to the Blockhouse (hereinafter called the "Project"), was approved by the Chief of Engineers on 3 September 1975 under authority granted by Section 205 of the 1948 Flood Control Act, as amended by Section 61 of the Water Resources Development Act of 1974, Public Law 93-251, approved 7 March 1974 (33 USCA 701s); and

WHEREAS, the Town hereby represents that it has the authority and capability to furnish the non-Federal cooperation required by the Federal legislation authorizing the Project and by other applicable law.

NOW, THEREFORE, the parties agree as follows:

1. The Town agrees that, if the Government shall commence construction of the local flood protection project on the St. John River, Fort Kent, Maine, substantially in accordance with the approval of the Chief of Engineers under Section 205 of the 1948 Flood Control Act, as amended, the Town shall, in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation, to wit:

a. Provide without cost to the United States all lands, easements, rights-of-way, utility relocations and alterations, and highway or highway bridge construction and alterations necessary for Project construction.

b. Maintain and operate the Project after completion, without cost to the United States, in accordance with the regulations prescribed by the Secretary of the Army;

c. Assume full responsibility for all Project costs in excess of the Federal cost limitation of \$2 million;

d. Prevent future encroachment which might interfere with proper functioning of the Project for flood control, including, adoption of building ordinances stipulating that all new building construction within the protected area have first floor grades above, or be flood proofed to, elevation 513 feet above mean sea level datum and keep to a minimum, filling in the areas presently lying below elevation 513 feet above m. s. l. just east of the International Bridge between Main and Elm Streets and in the center of the block

bordered by Main Street, Hall Road, and Elm Street. Any plans for future development within the protected area must be reviewed by the Government in the early planning stages in order to prevent major encroachments below elevation 513 m. s. l.; and

e. At least annually, notify local citizens that the Project does not provide complete flood protection (i. e. beyond the 100-year event).

2. The Town further agrees to comply with requirements of non-Federal cooperation specified in Sections 210 and 305 of Public Law 91-646, 91st Congress, S. I. approved 2 January 1971, known as the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970," to wit:

a. Fair and reasonable relocation payments and assistance shall be provided to or for displaced persons, as are required to be provided by a Federal agency under Sections 202, 203 and 204 of Public Law 91-646;

b. Relocation assistance programs offering the services described in Section 205 of Public Law 91-646 shall be provided to such displaced persons;

c. Within a reasonable period of time prior to displacement, decent, safe, and sanitary replacement dwellings will be available to displaced persons in accordance with 205 (c) (3) of Public Law 91-646;

d. In acquiring real property, the Town will be guided, to the greatest extent possible under its laws, by the land acquisition policies in Section 301 and the provisions of Section 302 of Public Law 91-646; and

e. Property owners will be paid or reimbursed for necessary expenses as specified in Sections 303 and 304 of Public Law 91-646.

3. The Town hereby gives ~~the~~ Government a right to enter upon, at reasonable times and in a reasonable manner, lands which the Town owns or controls, for access to the Project for the purpose of inspection, and for the purpose of completing, operating, repairing, and maintaining the Project, if such inspection shows that the Town for any reason is failing to complete, repair and maintain the Project in accordance with the assurances hereunder and has persisted in such failure after a reasonable notice in writing by the Government delivered to Town Official. No completion, operation, repair, and maintenance by the Government in such event shall operate to relieve the Town of responsibility to meet its obligations as set forth in paragraph 1 of this Agreement, or to preclude the Government from pursuing any other remedy at law or equity.

4. This Agreement is subject to the approval of the Secretary of the Army.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

THE UNITED STATES OF AMERICA THE TOWN OF FORT KENT

By

John H. Mason  
JOHN H. MASON  
Colonel, Corps of Engineers  
Division Engineer  
Contracting Officer

DATE: 26 January 1976

APPROVED:

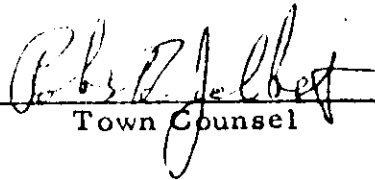
H. G. [illegible]  
Acting Director of Real Estate

FOR THE Secretary of the Army

By

Carlton J. Savage  
[illegible]  
[illegible]  
[illegible]  
[illegible]  
Town Council

I have reviewed the foregoing Agreement and have considered the effect of Section 221 of the Flood Control Act of 1970, Public Law 91-611, and I am satisfied that the Town can fully comply with the provisions of said Agreement. Accordingly, I approve the foregoing Agreement.

  
\_\_\_\_\_  
Town Counsel

CERTIFICATION

I, Patrick D. Pelletier, do hereby certify  
that I am the Town Clerk of the Town of Fort Kent, Maine, named herein;  
that Carlton J. Sawyer William A. Saucier,  
Frederick Harvey, Rose Wadeau,  
and Emery Labbe were then and there the duly elected and  
qualified members of the Town Council, and that said Agreement was duly  
signed for and on behalf of the Town of Fort Kent by virtue of a Town Council  
Vote dated January 26, 1976.

I further certify that Robert Talbert was  
Town Counsel.

Patrick D. Pelletier  
Town Clerk

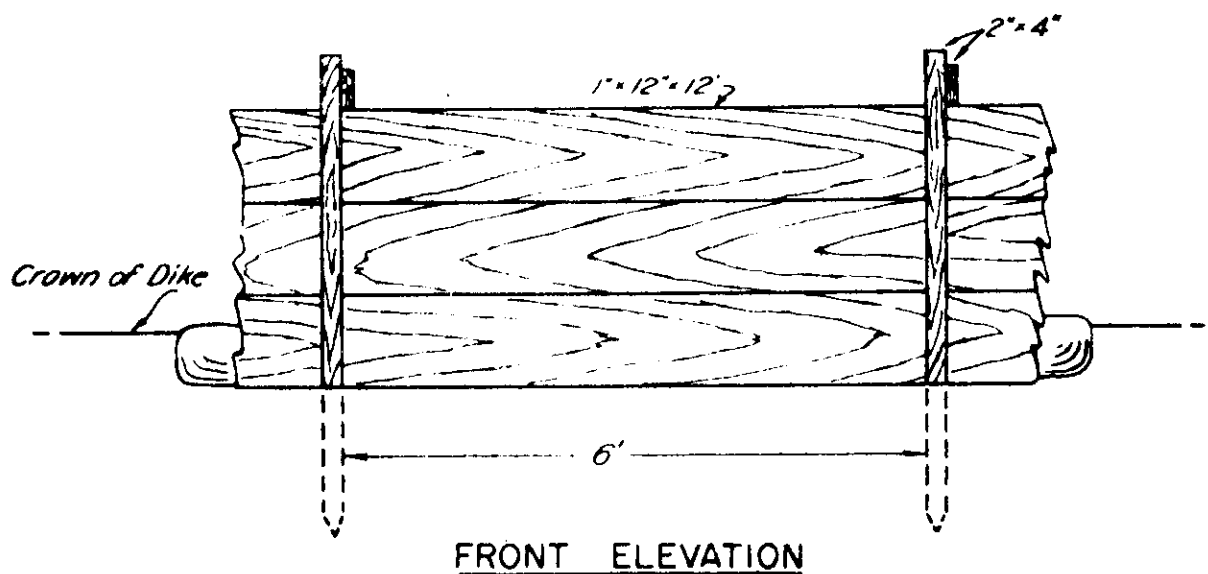
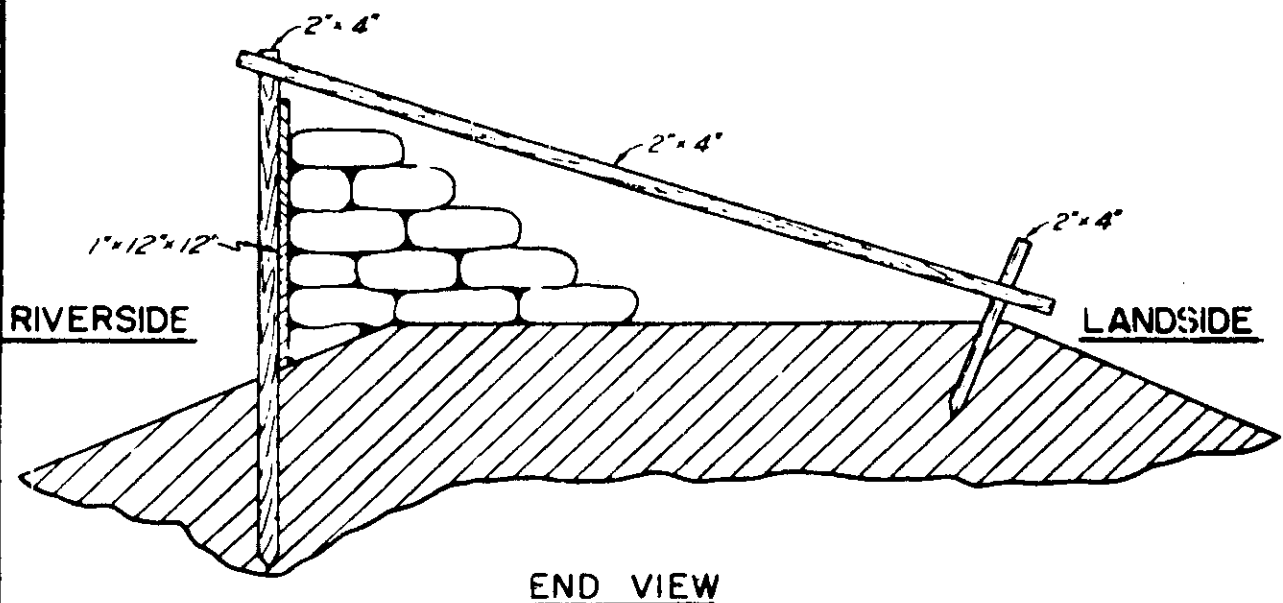
(Town Seal)

APPENDIX E

FLOOD EMERGENCY MEASURES

<u>Plate No.</u>	<u>Title</u>
I	Effect of Sand Boils
II	Sand Boil
III	Sacking Sloughs
IV	Sack Dike or Topping
V	Model Sack Dike or Topping
VI	Lumber and Sack Topping
VII	Flashboards





BILL OF MATERIAL TO CONSTRUCT 100 FEET

25 pcs. 1" x 12" x 12'

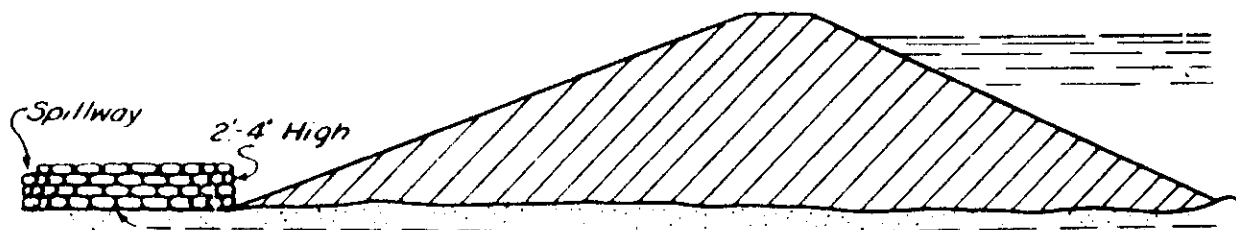
17 pcs. 2" x 4" x 6'

17 pcs. 2" x 4" x 10'

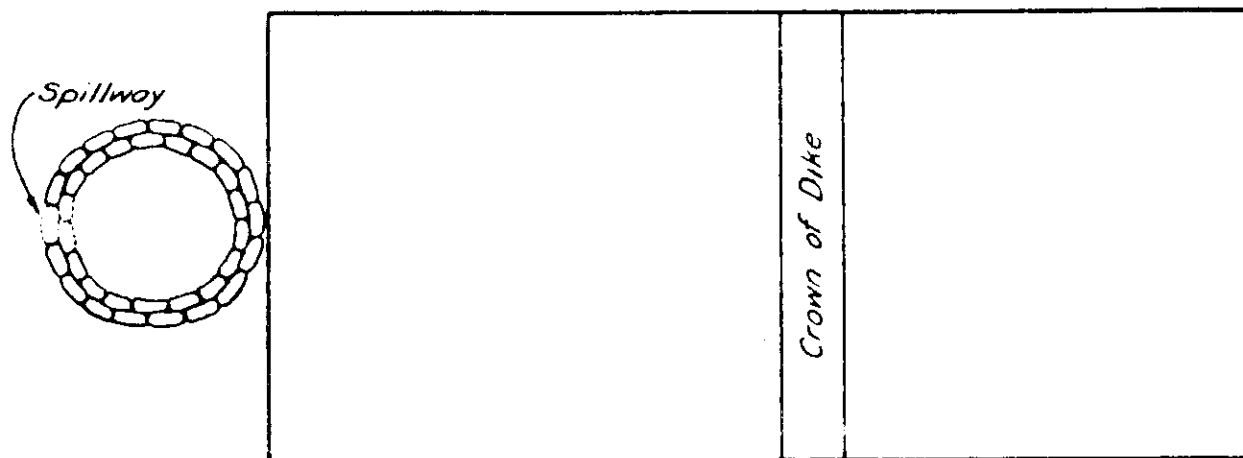
17 pcs. 2" x 4" x 2'

LUMBER AND SACK TOPPING  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.



Wall should be built on firm ELEVATION  
 foundation, with width of base  
 at least  $1\frac{1}{2}$  times the height.  
 Be sure to place sacks on ground  
 clear of sand discharge.  
 Tie into dike if boil is near toe.

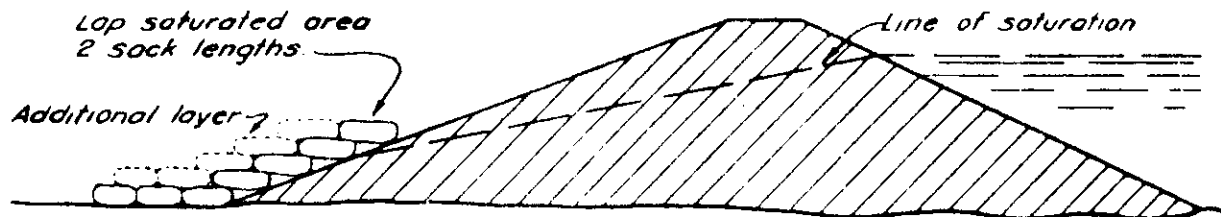


PLAN

*Do not sack boil which  
 does not put out material.  
 Height of sack loop or ring  
 should be only sufficient to  
 create enough head to slow  
 down flow through boil so  
 that no more material is dis-  
 placed and boil runs clear.  
 Do not try to stop fully, flow  
 through boil.*

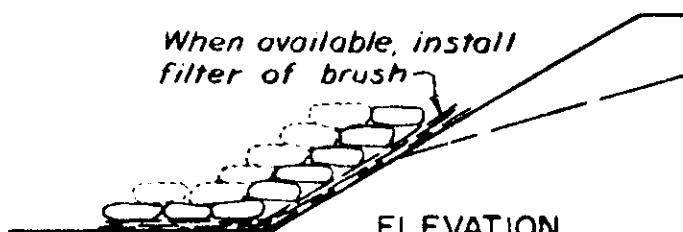
**SAND BOIL  
 STANDARD HIGH WATER  
 MAINTENANCE INSTRUCTION**

DEPARTMENT OF THE ARMY  
 NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
 WALTHAM, MASS.

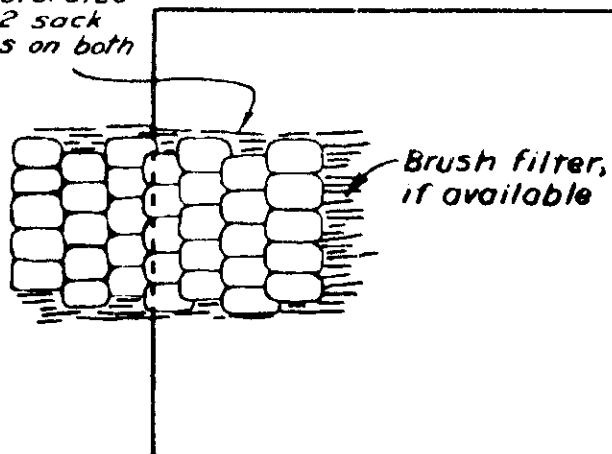
ELEVATION

*Number of layers determined by velocity of seepage and amount of material being carried*

*When available, install filter of brush*

ELEVATION

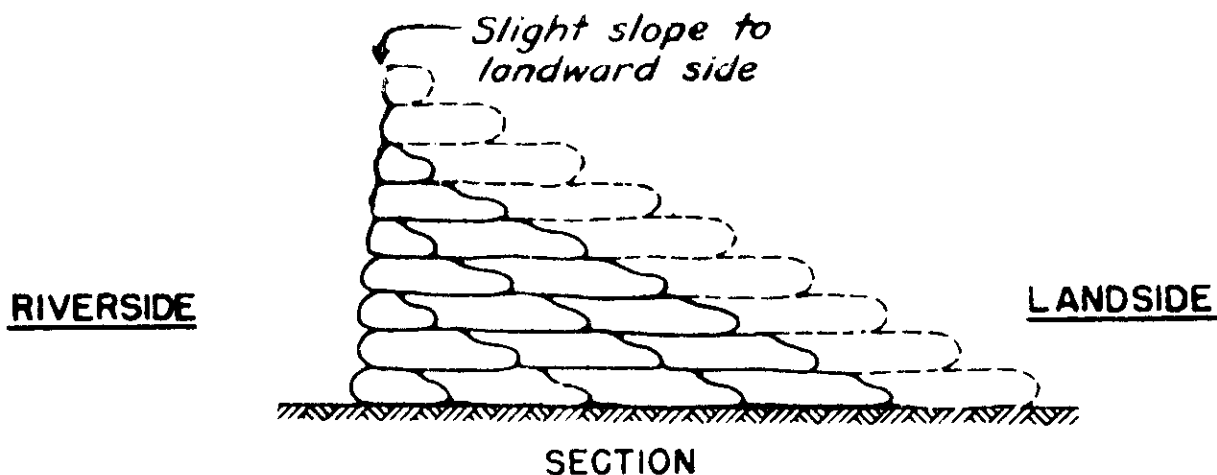
*Lap saturated area 2 sack widths on both ends*

PLAN

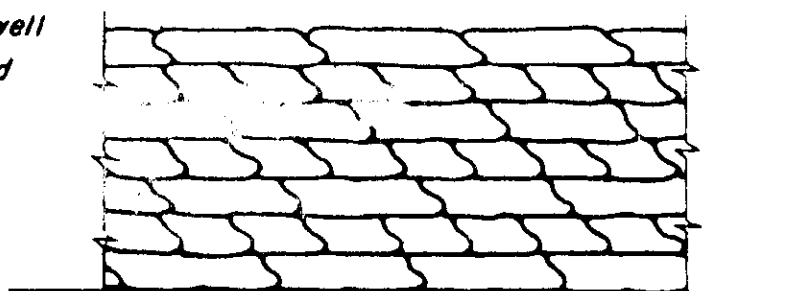
*Sacks should be laid shingle fashion and not matted into place*

## SACKING SLOUGHS STANDARD HIGH WATER MAINTENANCE INSTRUCTION

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.



*Note: Sacks should be lapped at least 1/3 all ways and well mauled or tamped into place.*



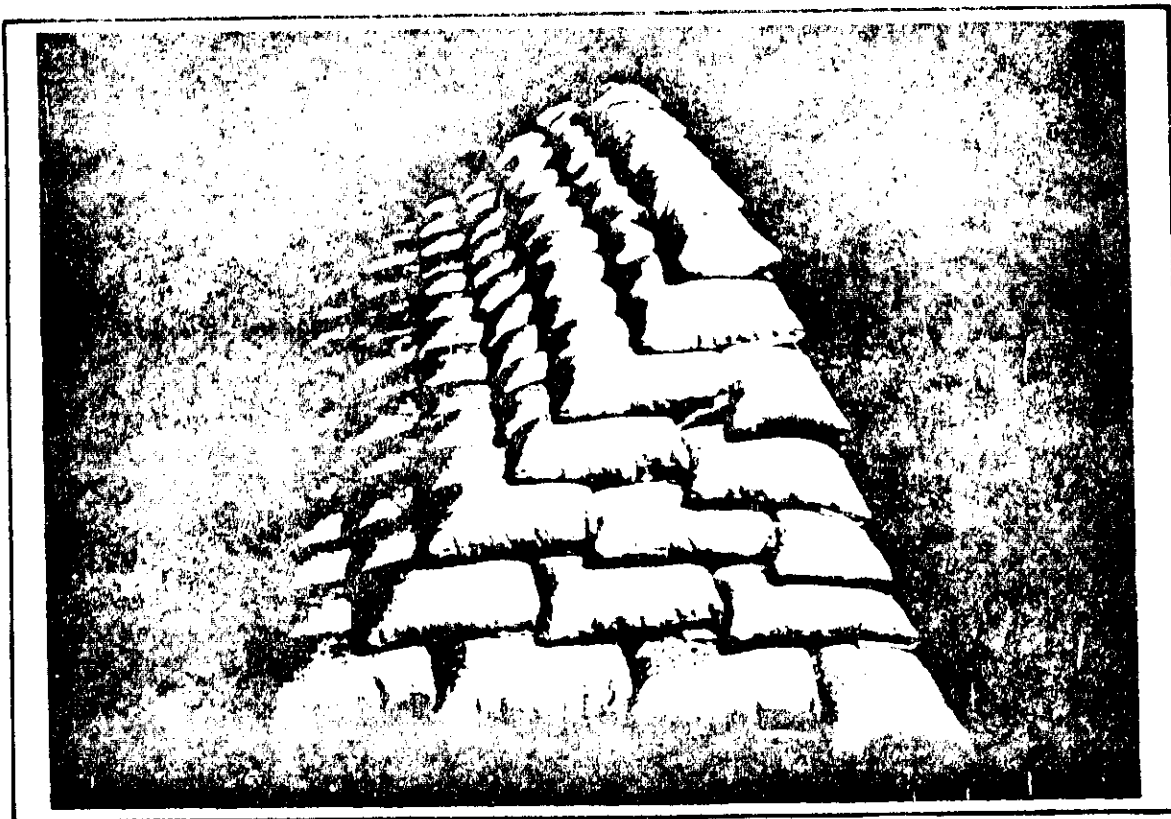
RIVERSIDE ELEVATION

SACKS REQUIRED PER 100' STA.  
100 lb. "Feed" Sacks - 1 Cu. Ft. Each

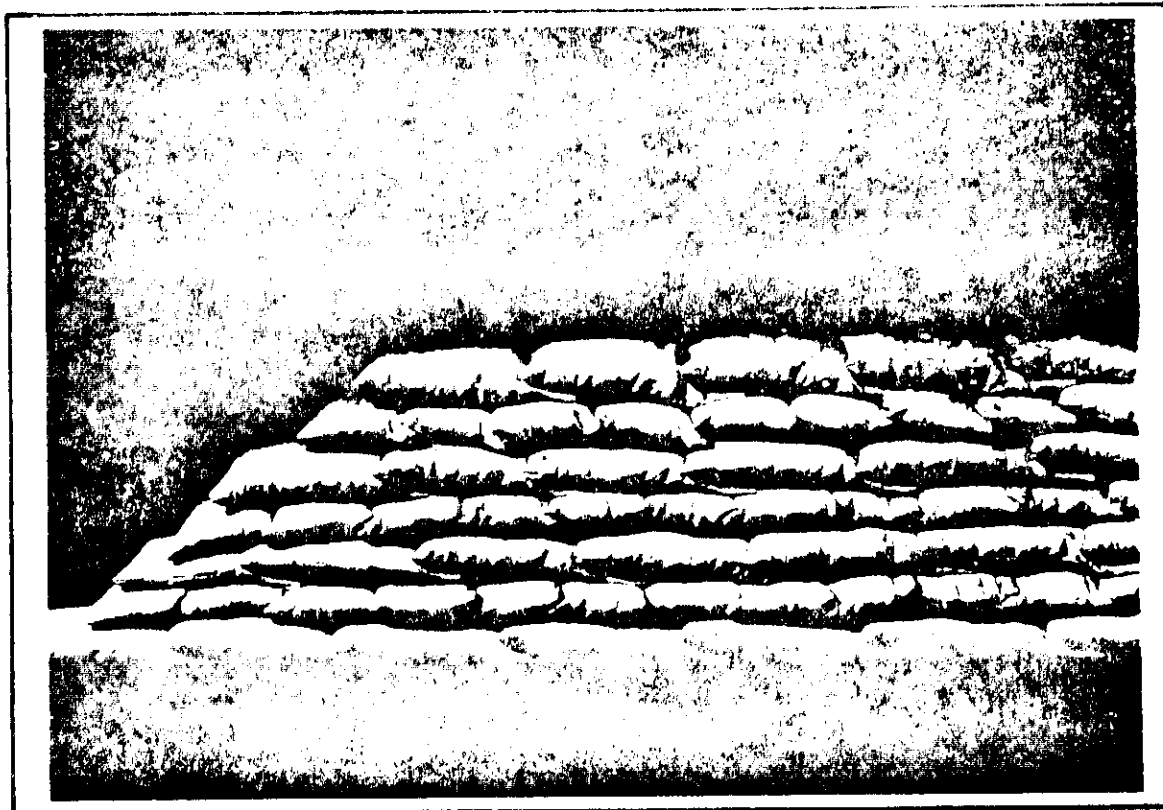
Approx. Hgt. Sack Dike	Sacks High	Required
1.5	3	300
2.0	4	750
3.0	6	1400
4.0	8	2250
5.0	10	3250
6.0	12	4500
7.0	14	5950
8.0	16	7600

SACK DIKE OR TOPPING  
STANDARD HIGH WATER  
MAINTENANCE INSTRUCTION

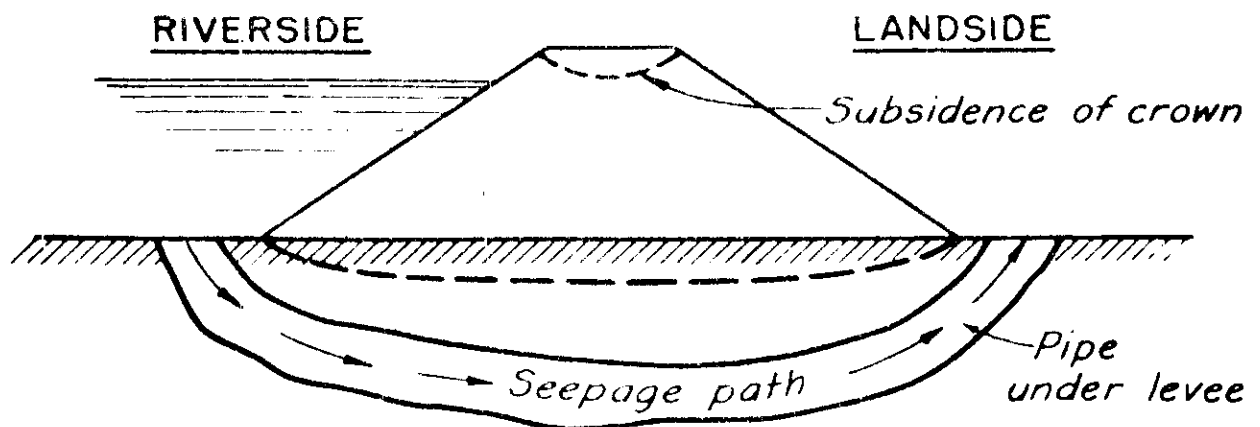
DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.



MODEL SACK DIKE OR TOPPING  
Typical Section

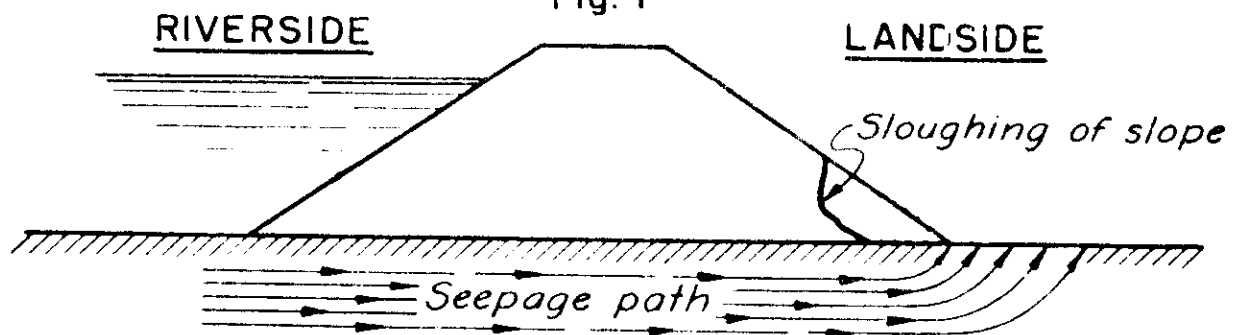


MODEL SACK DIKE OR TOPPING  
Riverside View



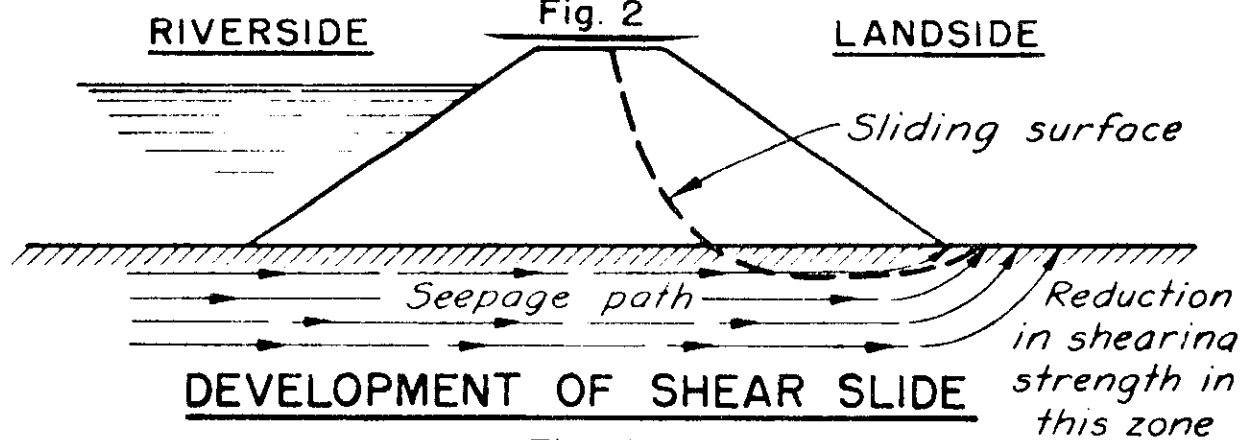
### DEVELOPMENT OF PIPE UNDER LEVEE

Fig. 1



### SLOUGHING OF LANDSLIDE SLOPE DUE TO RAVELLING AND UNDERCUTTING OF TOE

Fig. 2



### DEVELOPMENT OF SHEAR SLIDE

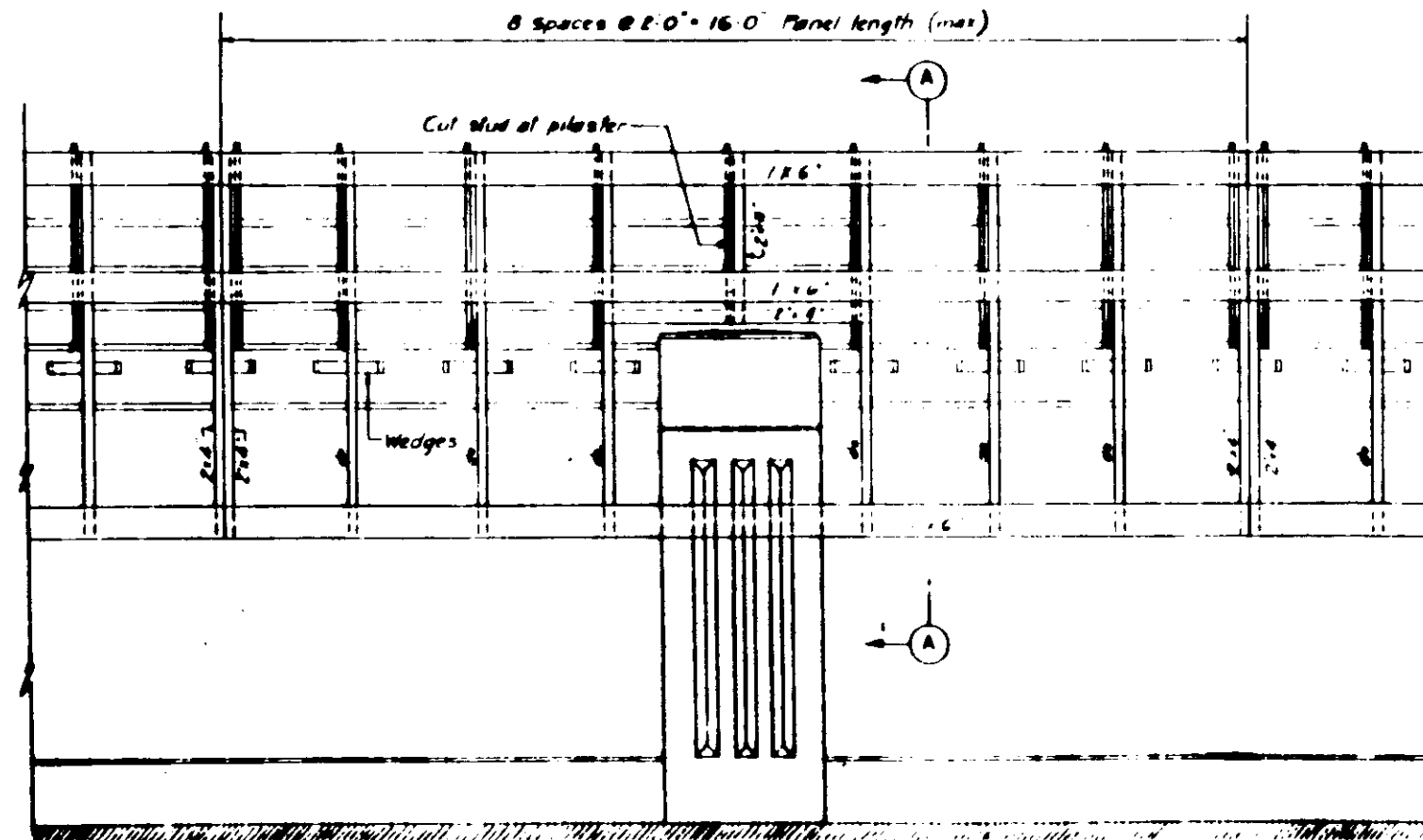
Fig. 3

### EFFECTS OF SAND BOILS ON LEVEE

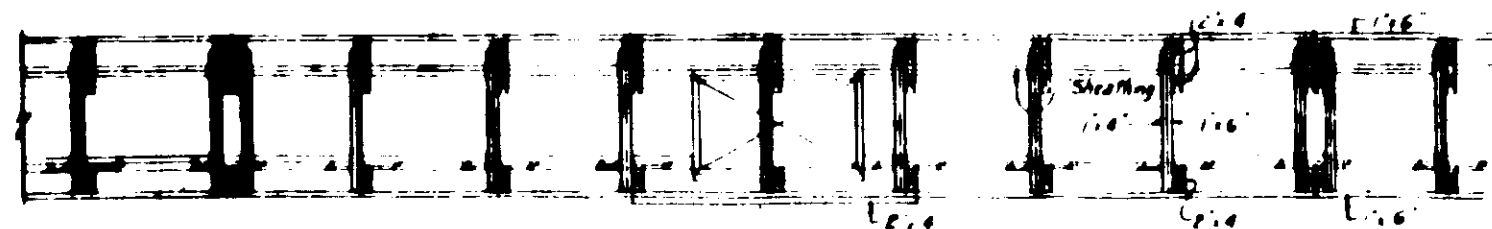
EMERGENCY PROCEDURE MANUAL  
FOR DISASTER RELIEF

( VOLUME II, PART I )

"FLOOD FIGHTING"



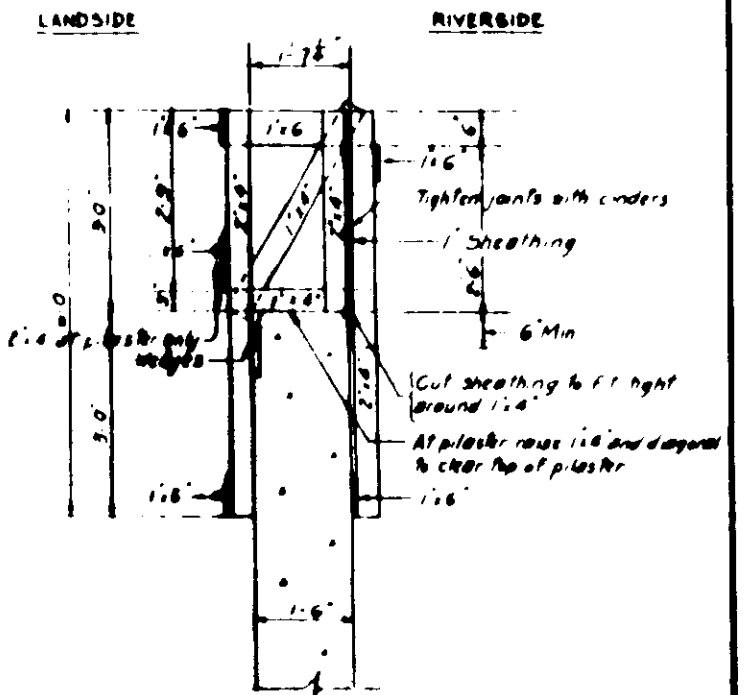
LANDSIDE ELEVATION



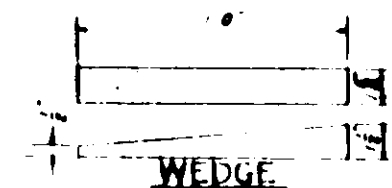
PLAN

BILL OF MATERIALS		
For one 8' 0" panel Regular wall section		
Uprights	10 pcs	2" x 4" x 6' 0"
Wall brace	5"	2" x 4" x 8' 0"
Stringers	5"	1" x 6" x 8' 0"
Upper ties	5"	1" x 6" x 2' 3"
Lower ties	5"	1" x 6" x 2' 3"
Diagonals	5"	1" x 4" x 8' 6"
Sheathing	6	1" x 6" x 8' 0" or random widths to make up 86'
Wedges	8	(3/4" thick) 2" x 4" x 8' 0" or 2" x 4" x 6'

For one 8' 0" panel. Pilaster section  
Same as above list except  
Substitute one upright 2" x 4" x 9' for one 2" x 4" x 6'  
Add one stringer piece 2" x 4" x 2'



SECTION A-A



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTHAM, MASS.

## EMERGENCY FLASH BOARDS FOR FLOOD WALLS

DATE:

PLATE NO XII

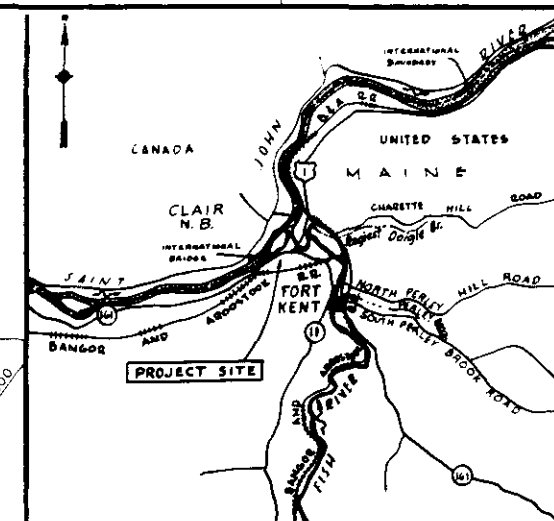
**APPENDIX F**

**AS-BUILT DRAWINGS**



## GENERAL NOTES:

1. Elevation refers to Mean Sea Level Datum.
2. All elevations are plus except as noted otherwise.
3. Dimensions are in feet unless otherwise noted.
4. Figures in parentheses indicate item numbers under which payment will be made.
5. Bid item references are shown on the drawings for convenience only. Under no circumstances should these items be used without reference to the specifications which describe the work and bid item. Should there be any discrepancies between the work covered by the bid item numbers as shown on the drawings and in the specifications, the specifications shall govern.
6. For central see sheet 2.
7. For record of sub-surface explorations see Division I of the specifications.



## LOCATION MAP

SCALE: 1" = 1 MILE (APPROX.)

INDEX TO DRAWINGS		
DRAWING NO.	SHEET NO.	TITLE
FOR - 1	1	GENERAL PLAN AND INDEX
"	2	CONTROL
"	3	PLAN NO. 1
"	4	PLAN NO. 2 AND GABION WALL DETAIL
"	5	PLAN NO. 3 AND PLANTING PLAN
"	6	PROFILE ALONG E OF DIKE
"	7	TYPICAL SECTIONS NO. 1
"	8	TYPICAL SECTIONS NO. 2
"	9	TYPICAL SECTIONS NO. 3
"	10	RAMPS-PLANS, PROFILES AND SECTION
"	11	DRAINAGE PLAN NO. 1
"	12	DRAINAGE PLAN NO. 2
"	13	DRAINAGE PLAN NO. 3
"	14	PRESSURE CONDUIT PROFILE AND UTILITY DETAILS
"	15	PUMPING STATION- SITE PLAN AND SECTIONS
"	16	PUMPING STATION-ARCHITECTURAL-PLANS, ELEVATIONS AND SECTIONS
"	17	PUMPING STATION-ARCHITECTURAL-SECTIONS AND DETAIL
"	18	PUMPING STATION-REINFORCEMENT DETAILS NO. 1
"	19	PUMPING STATION-REINFORCEMENT DETAILS NO. 2
"	20	PUMPING STATION-REINFORCEMENT DETAILS NO. 3
"	21	PUMPING STATION-STRUCTURAL-MASONRY WALL DETAIL
"	22	PUMPING STATION-MECHANICAL-PLANS, SECTIONS AND DETAILS
"	23	PUMPING STATION-MECHANICAL - MISCELLANEOUS DETAILS
"	24	PUMPING STATION-DISCHARGE PIPING-PLAN, ELEVATION AND DETAILS
"	25	PUMPING STATION- ELECTRICAL-PLANS, DIAGRAM AND SCHEDULE
"	26	OUTLET STRUCTURE AND HEADWALL-STRUCTURAL PLANS AND SECTIONS
"	27	SLUICE GATES-STRUCTURAL- PLANS, SECTIONS AND DETAILS
"	28	FLASHBOARDS AND I-WALL- STRUCTURAL-PROFILE AND DETAILS
"	29	HYDROGRAPHS NO. 1
"	30	HYDROGRAPHS NO. 2
"	31	HYDROGRAPHS NO. 3
"	32	HYDROGRAPHS NO. 4
"	33	HYDROGRAPHS NO. 5

## PLAN

SCALE 1" = 100'

## DRAWINGS INCLUDED WITH SPECIFICATIONS

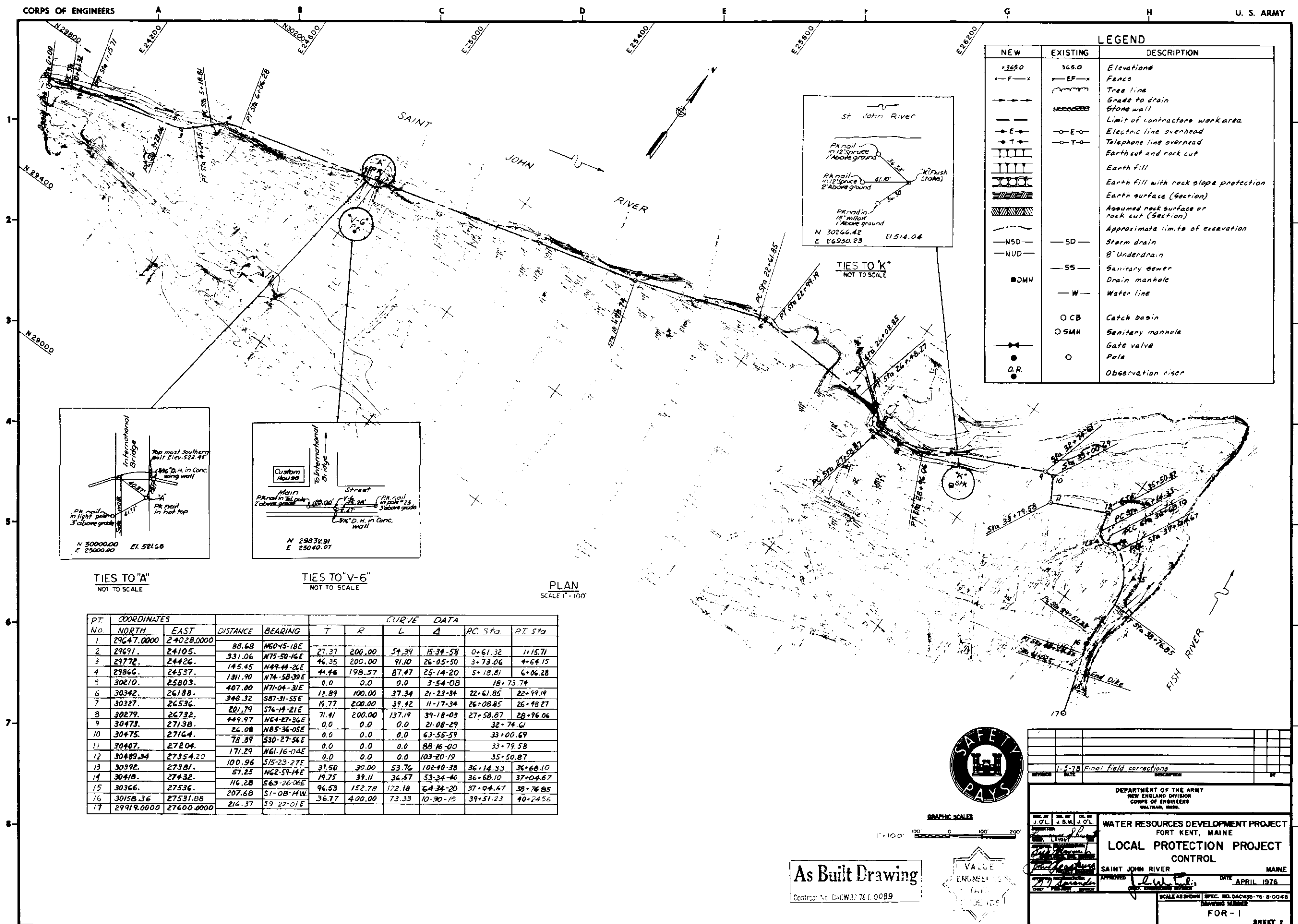
DRAWING NO.	SHEET NO.	TITLE
STD-36	1	SAFETY SIGN
40-06-04	3	INTERIOR ELECTRICAL
40-06-04	10	INTERIOR ELECTRICAL
40-06-04	30-A	INTERIOR ELECTRICAL
40-16-09		FENCE DETAILS
NED 1009A		TREES AND SHRUBS
STD-50		CAST IRON FRAME, GRATE AND COVER
STD-60		TYPICAL STORM DRAIN MANHOLE
40-02-03		WATERSTOPS- TYPES U & Y
SK-260		MATERIALS LABORATORY
STD-22A		BICENTENNIAL LOCAL PROTECTION AND "BUILD TOMORROW TODAY"

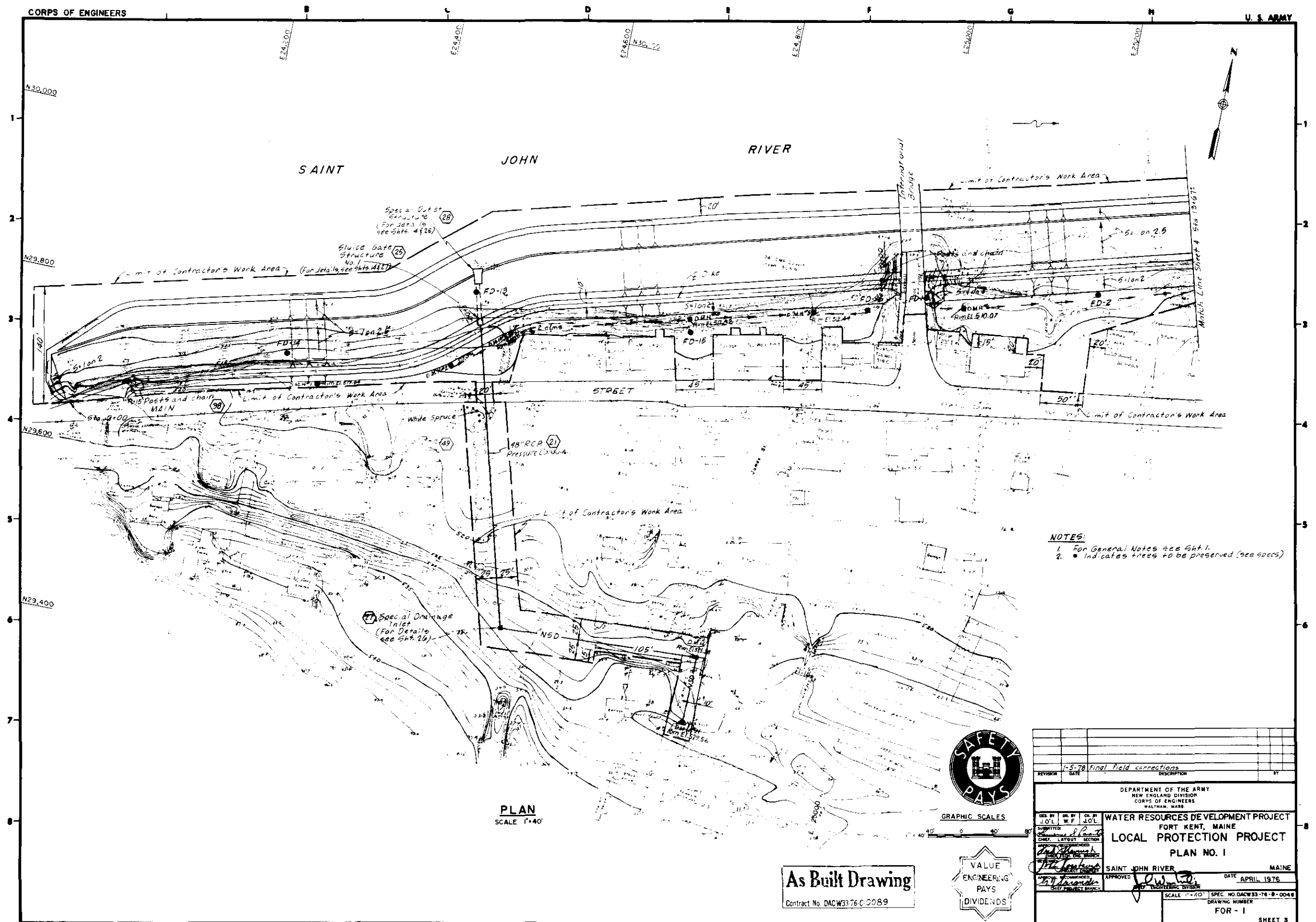


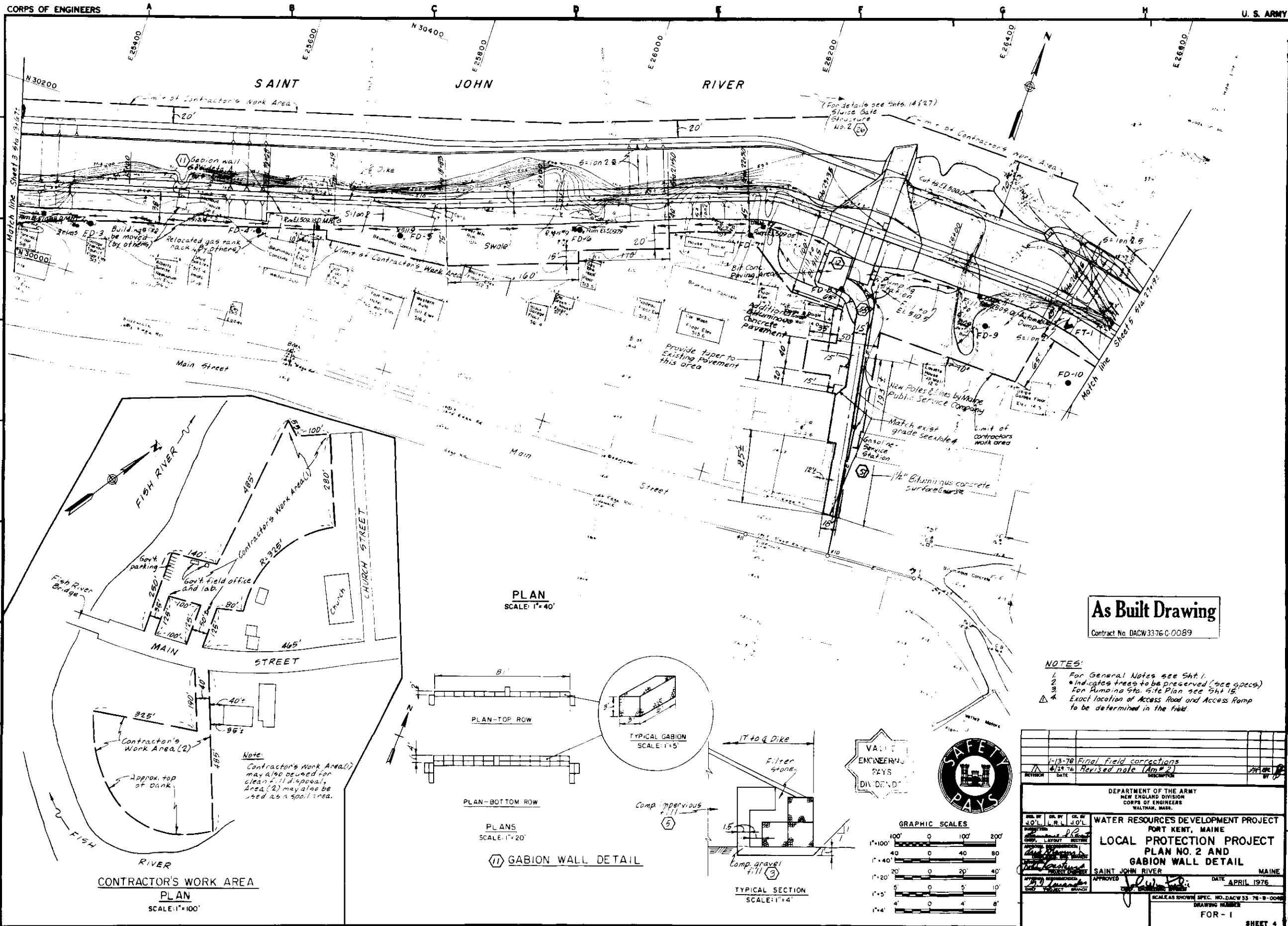
As Built Drawing

Contract No. DACW3776 G-0089

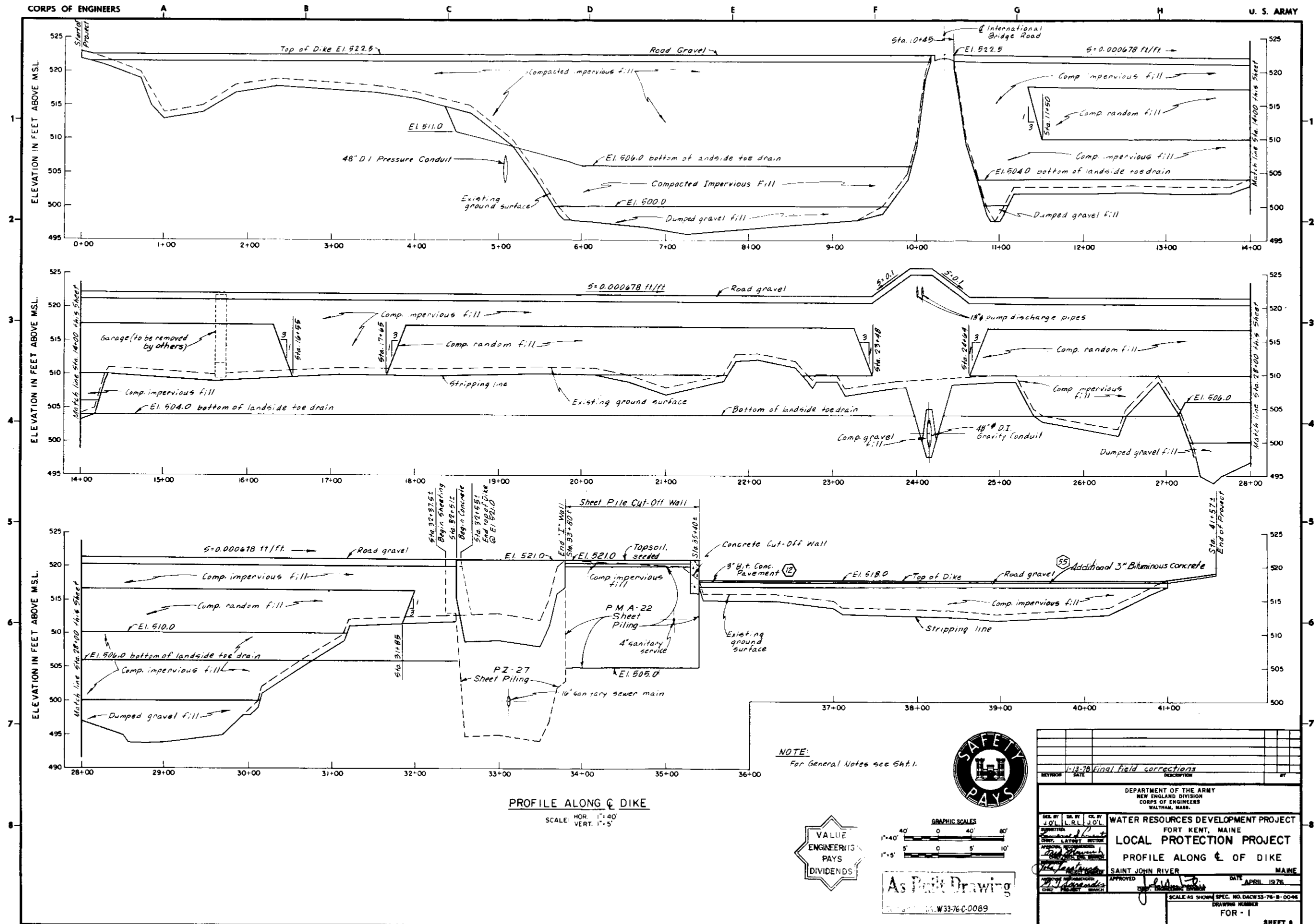
1-1376 Final field corrections			
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.			
WATER RESOURCES DEVELOPMENT PROJECT FORT KENT, MAINE			
LOCAL PROTECTION PROJECT GENERAL PLAN AND INDEX			
SAINT JOHN RIVER			
APRIL 1976			
SHEET 1			

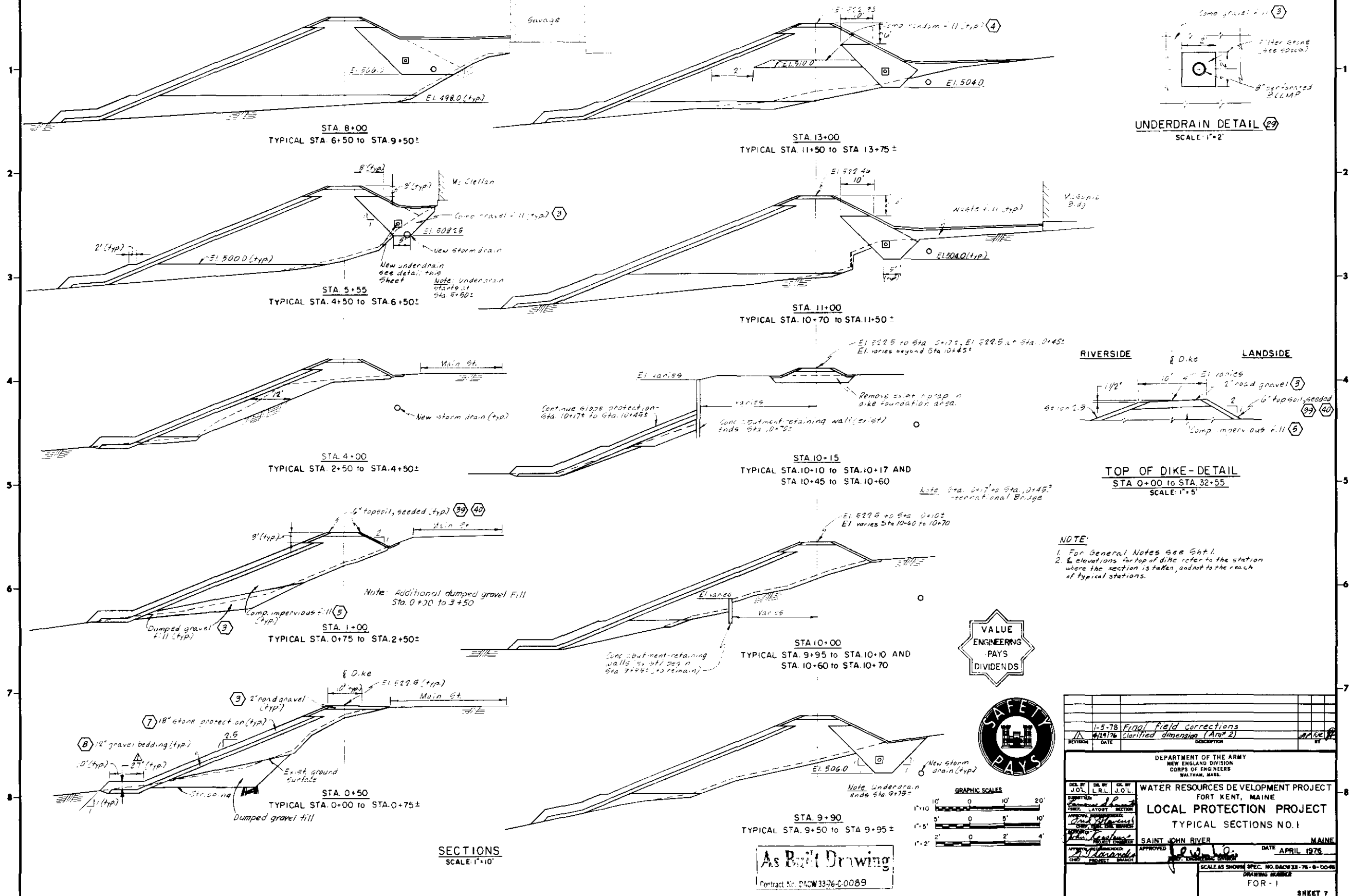


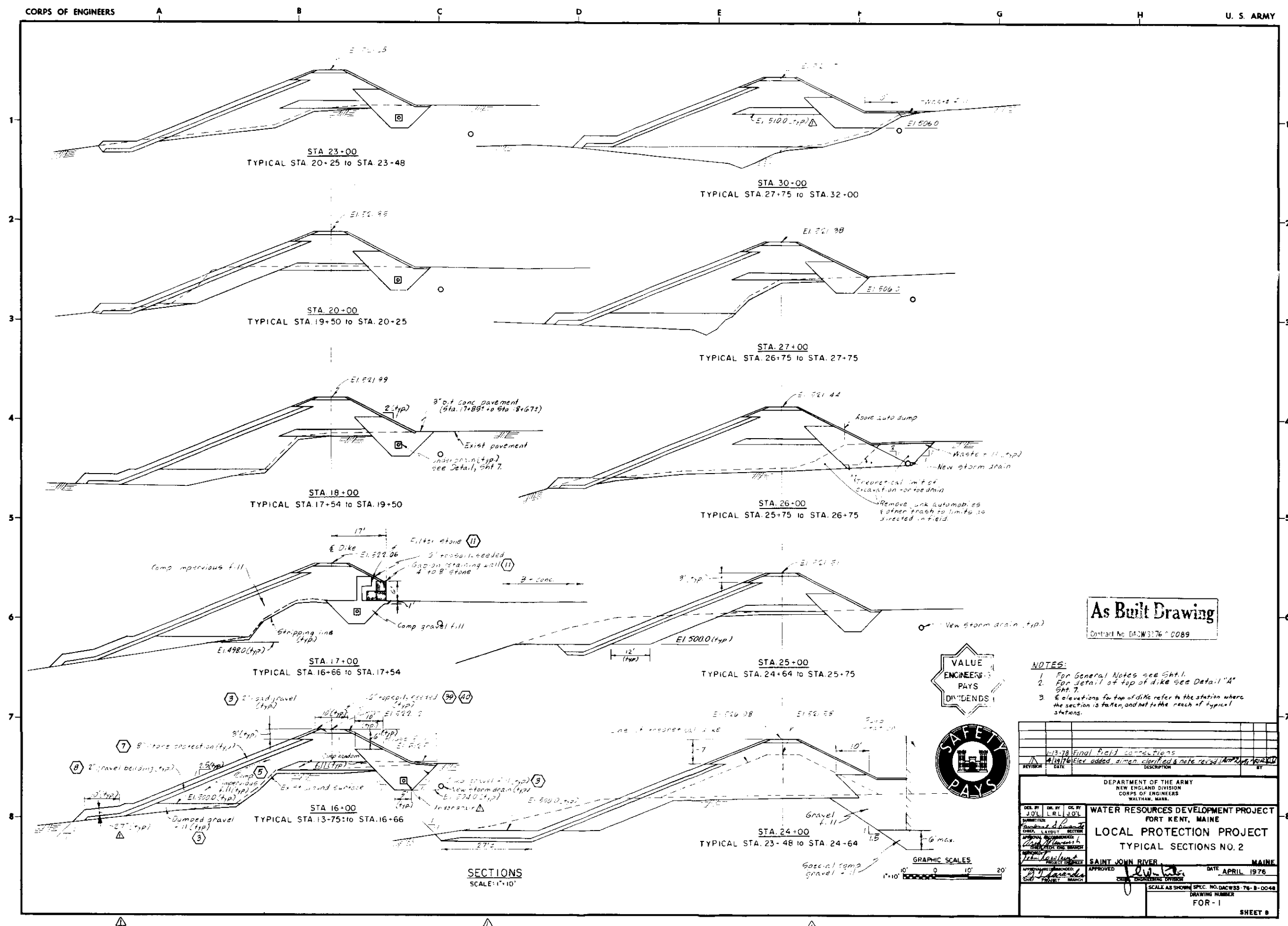




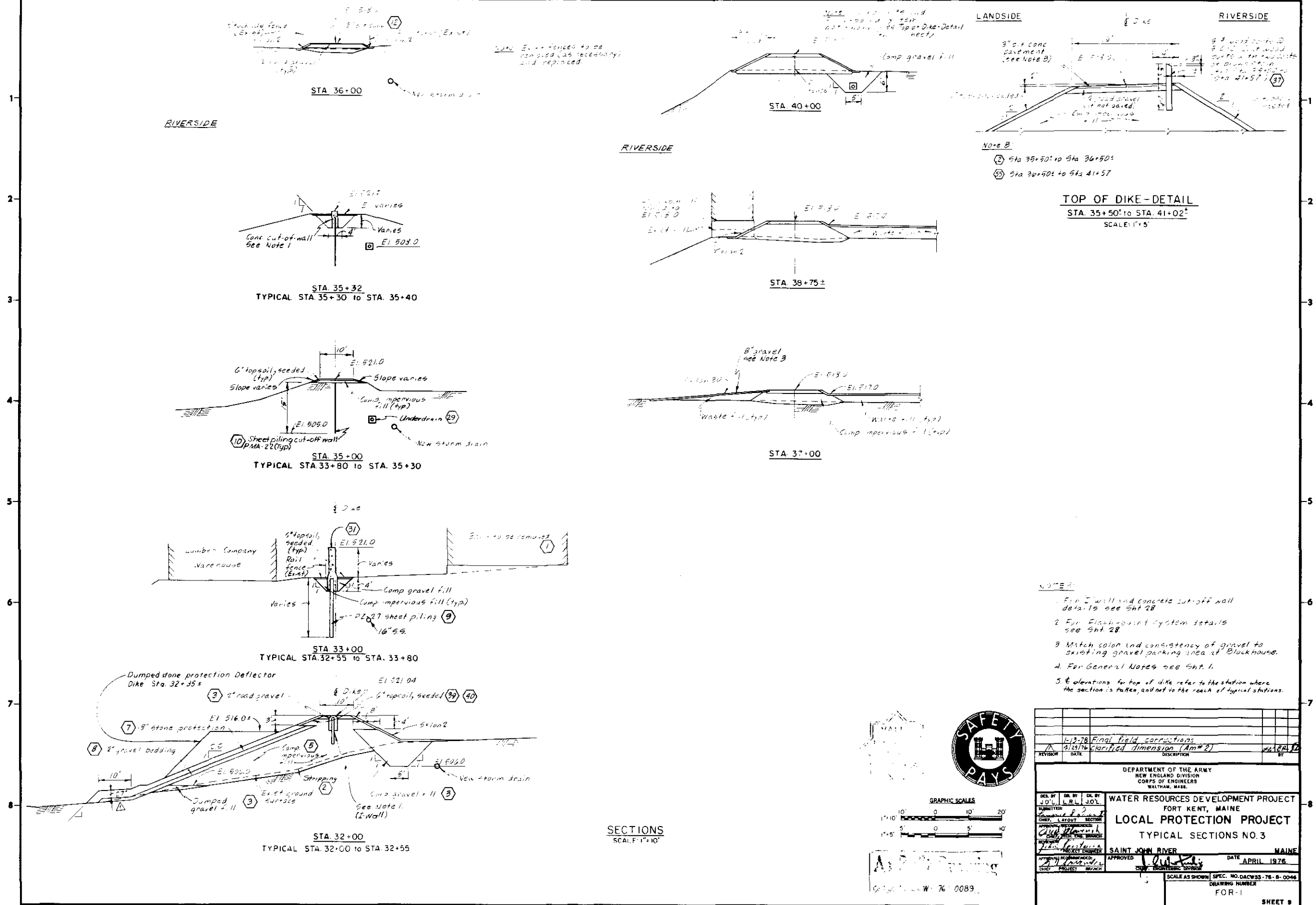


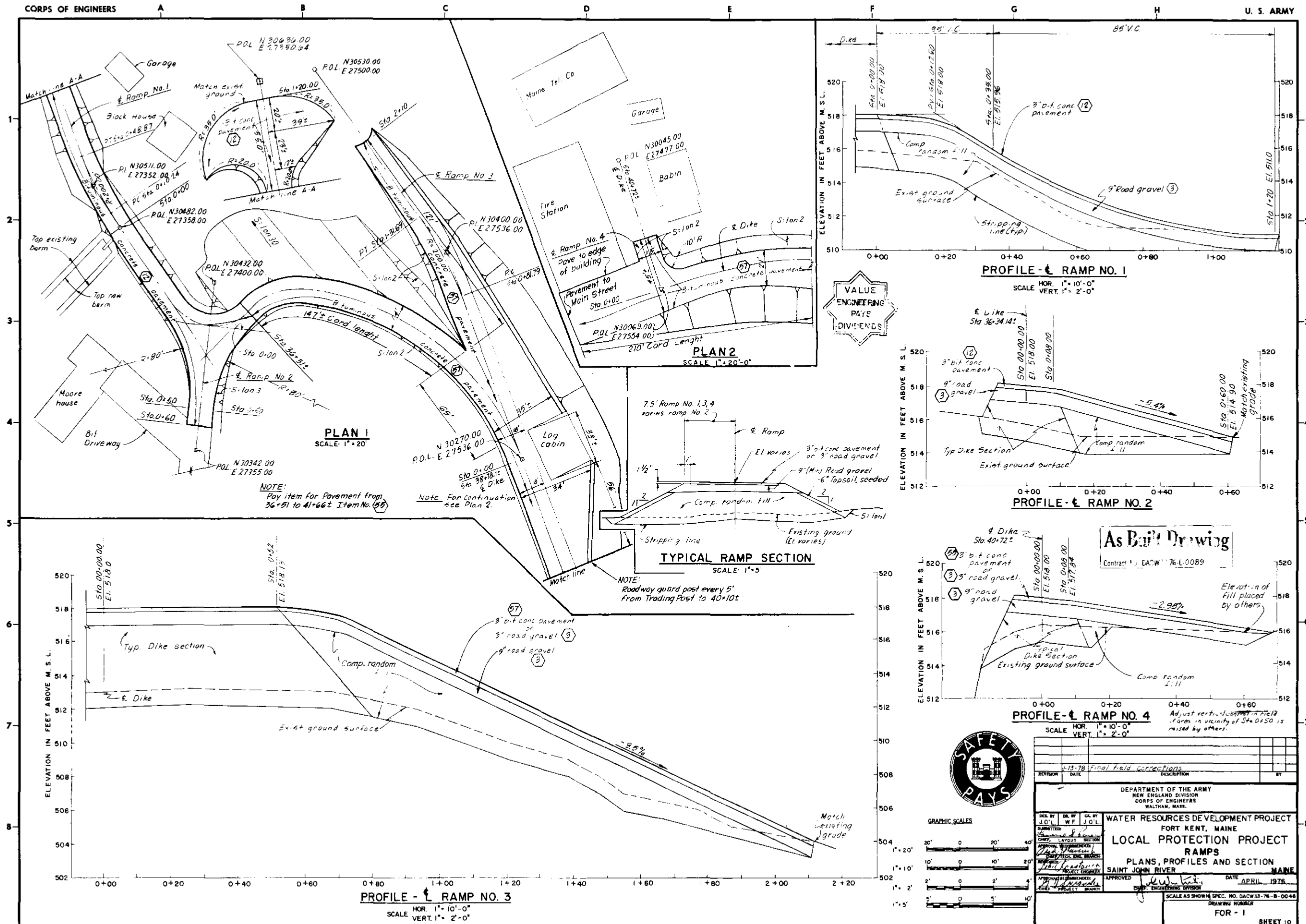


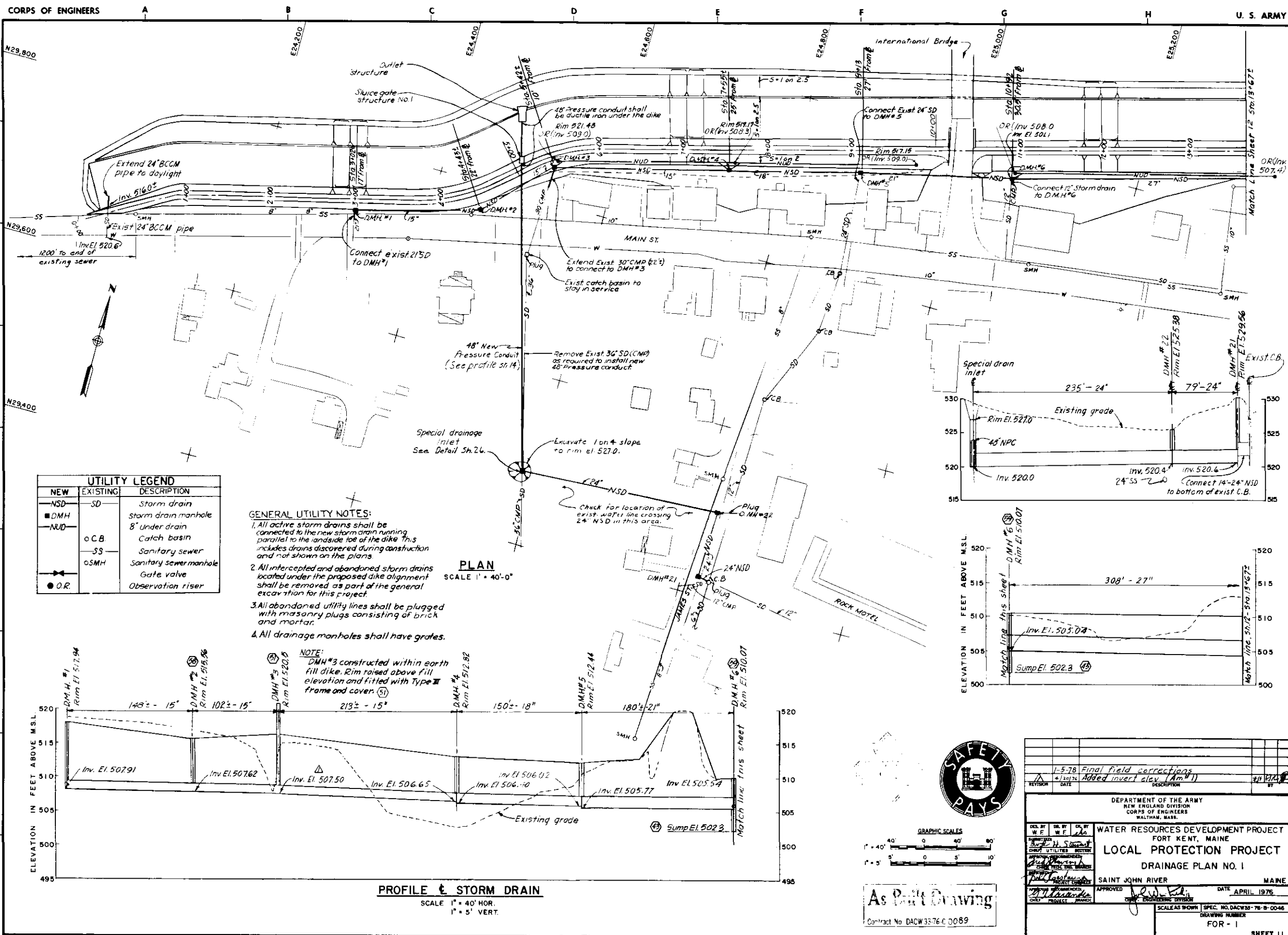


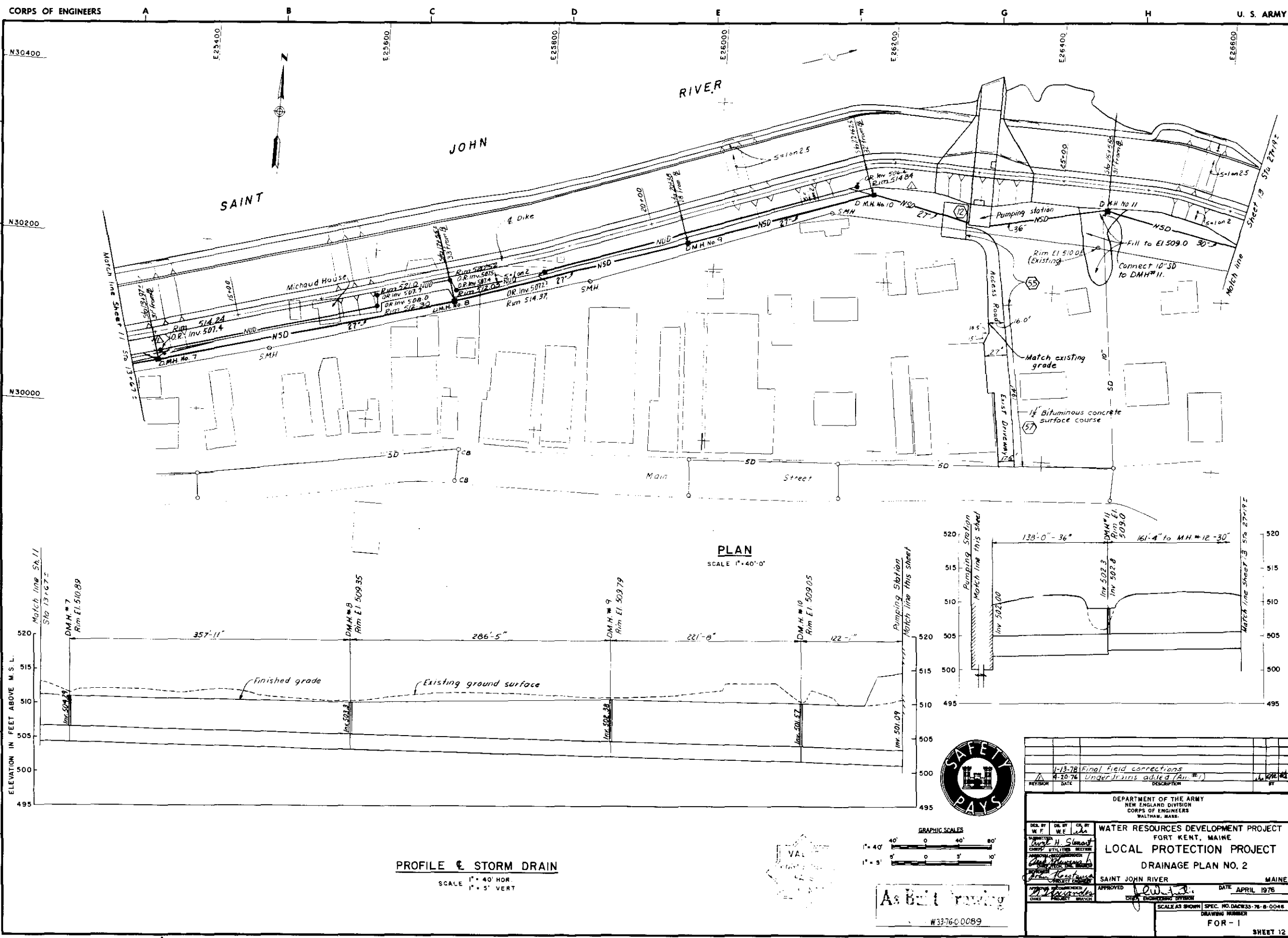


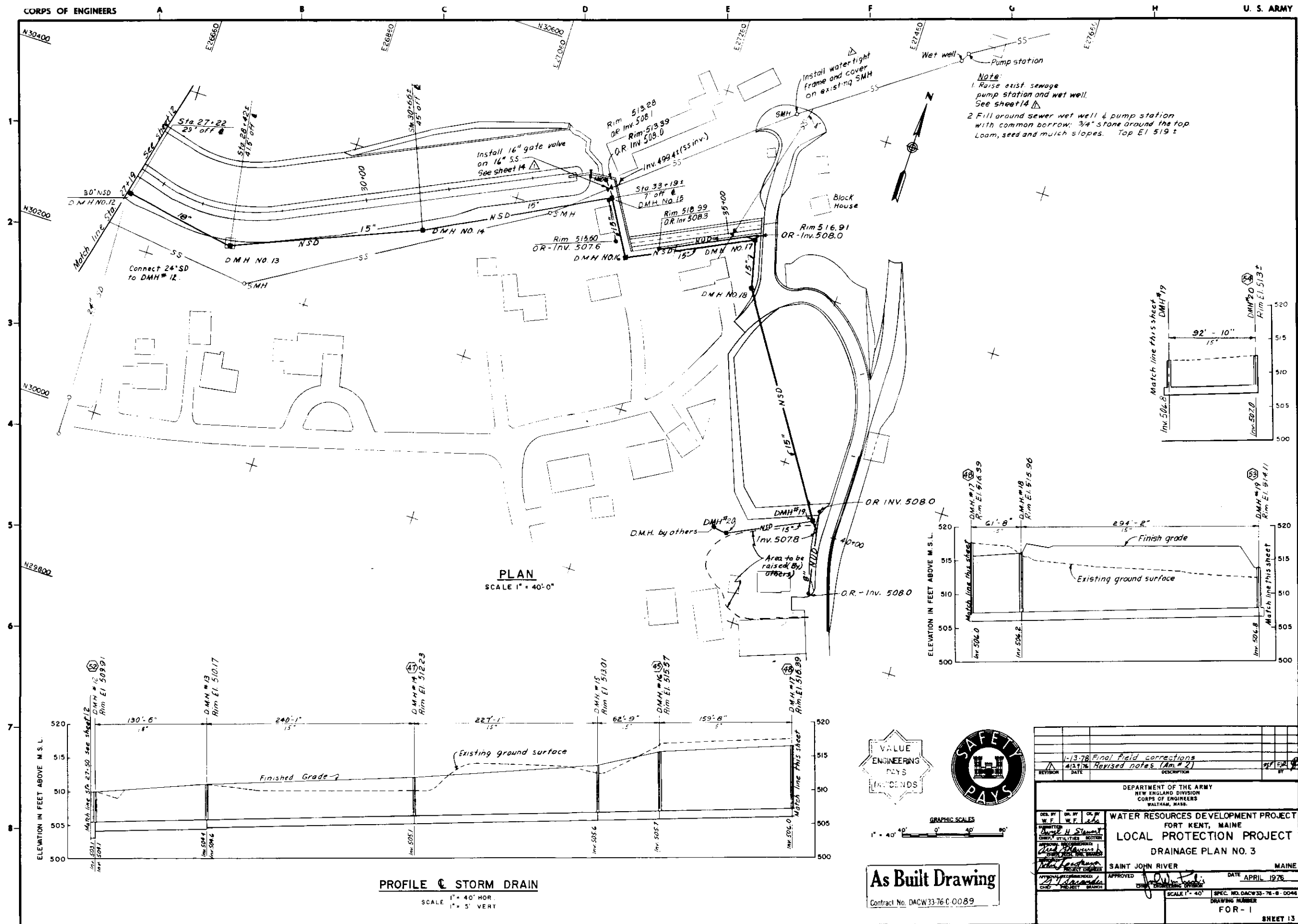




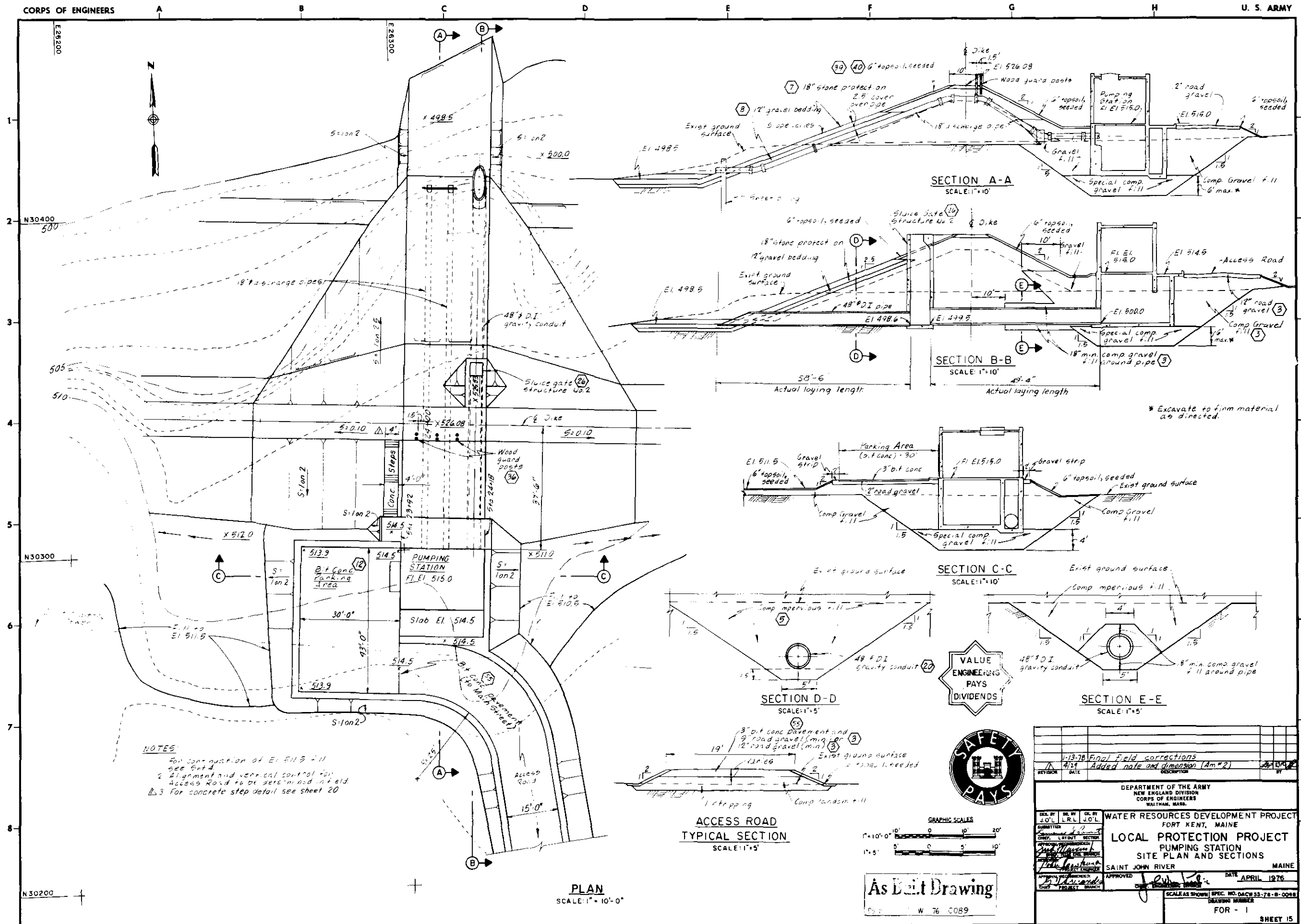


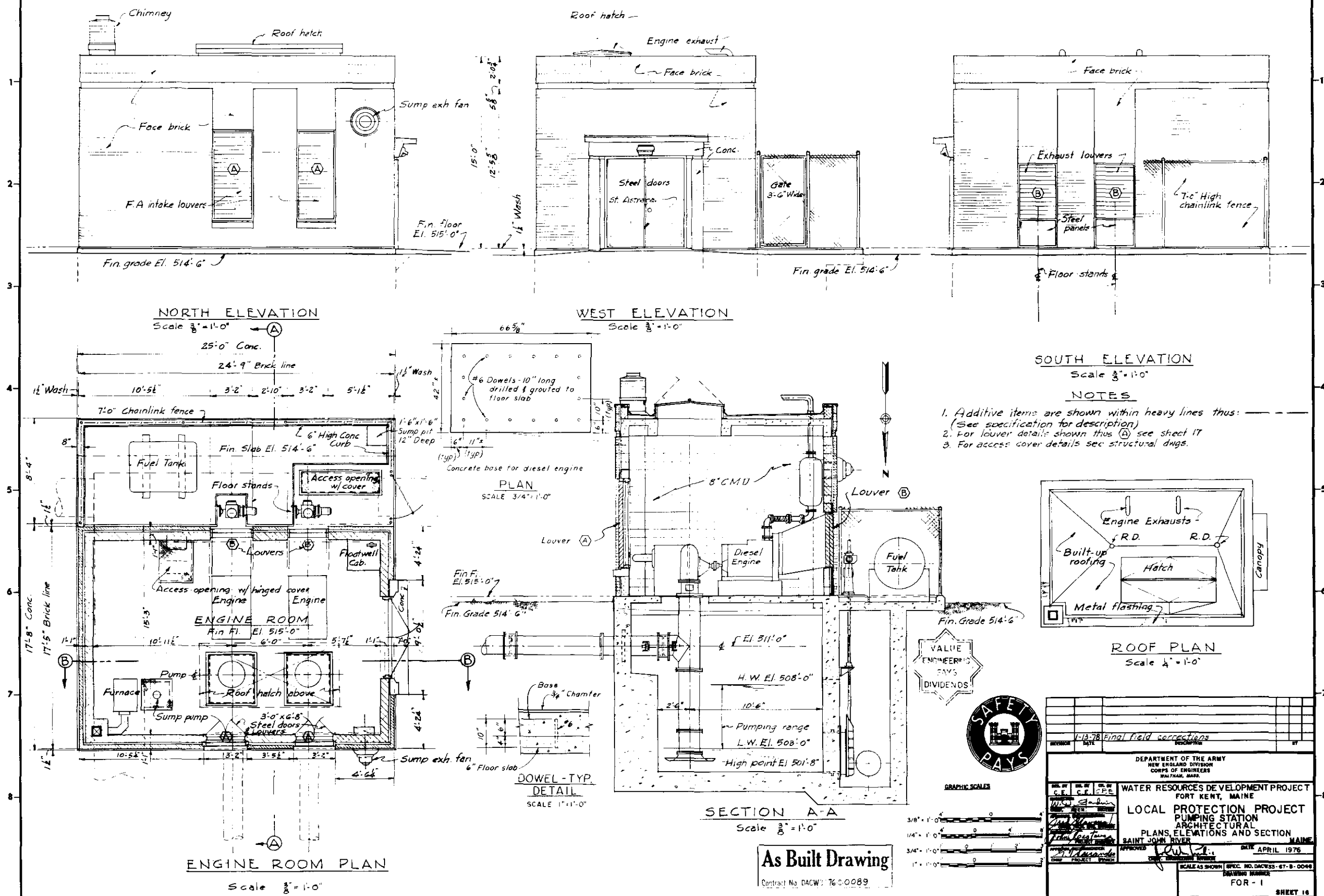




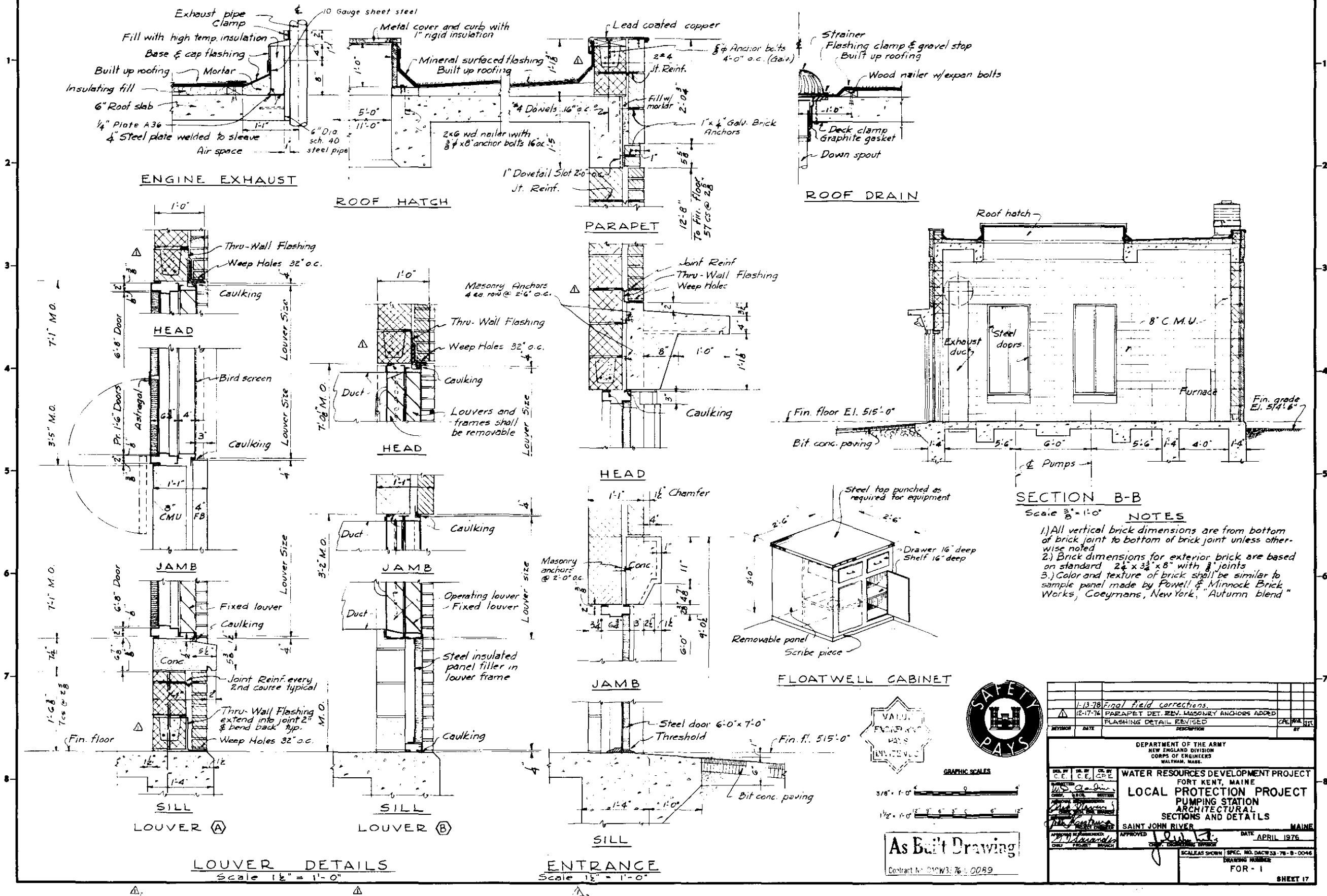


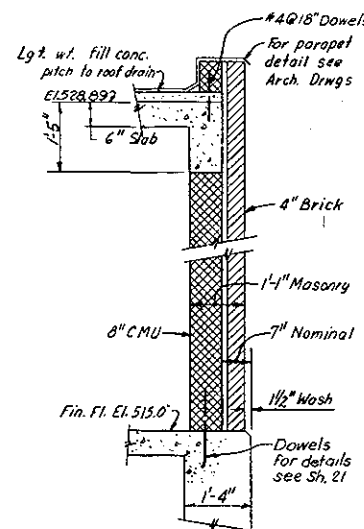
[illegible]







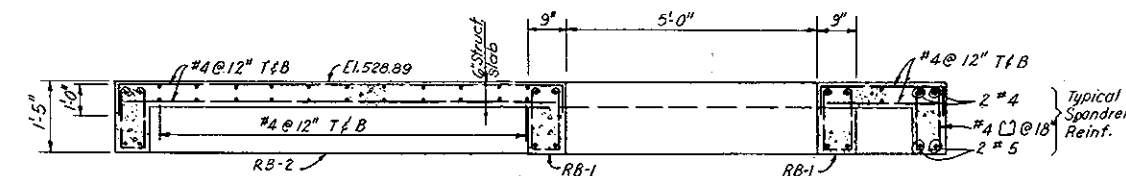




TYPICAL WALL SECTION

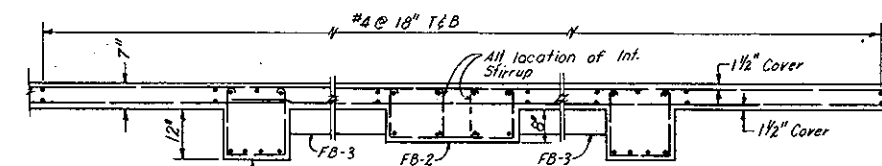
SCALE 3/8" = 1' - 0"

SCALE 3/4" = 1' - 0"



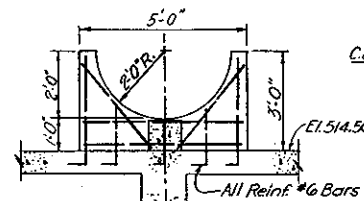
SCALE 3/4" = 1'-0"

SCALE 3/4" = 1'-0"



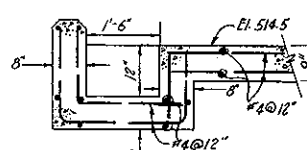
OPERATING FLOOR AND FLOOR BEAMS

SCALE 3/4" = 1'-0"



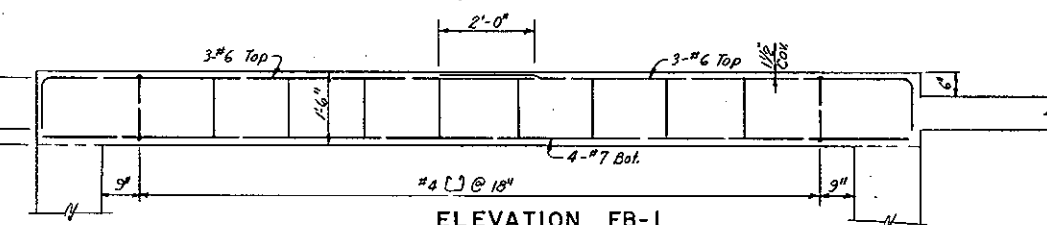
CONC. SADDLES  
FOR FUEL TANK

SCALE 1"=1'-0"

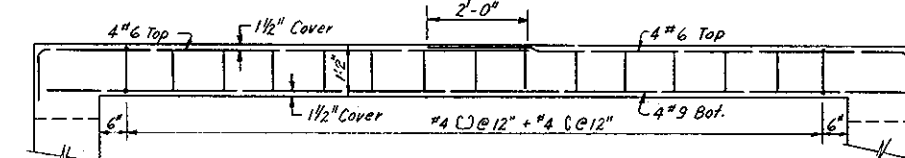


SECTION C-C

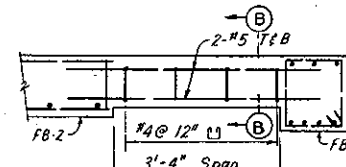
SCALE: 3/4"=1'-0"



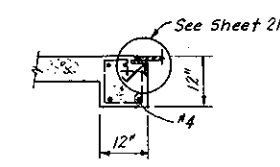
ELEVATION FB-1



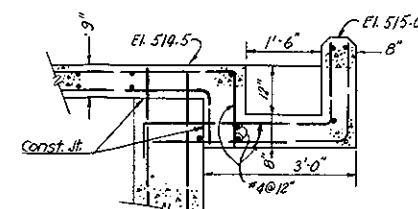
ELEVATION FB-2



ELEVATION FB-3

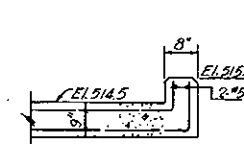


SECTION B-B



SECTION D-D

SCALE: 3/4"=1'-0"

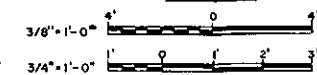


SECTION E-E .  
CURB DETAIL

SCALE 3/4"=1'-0"



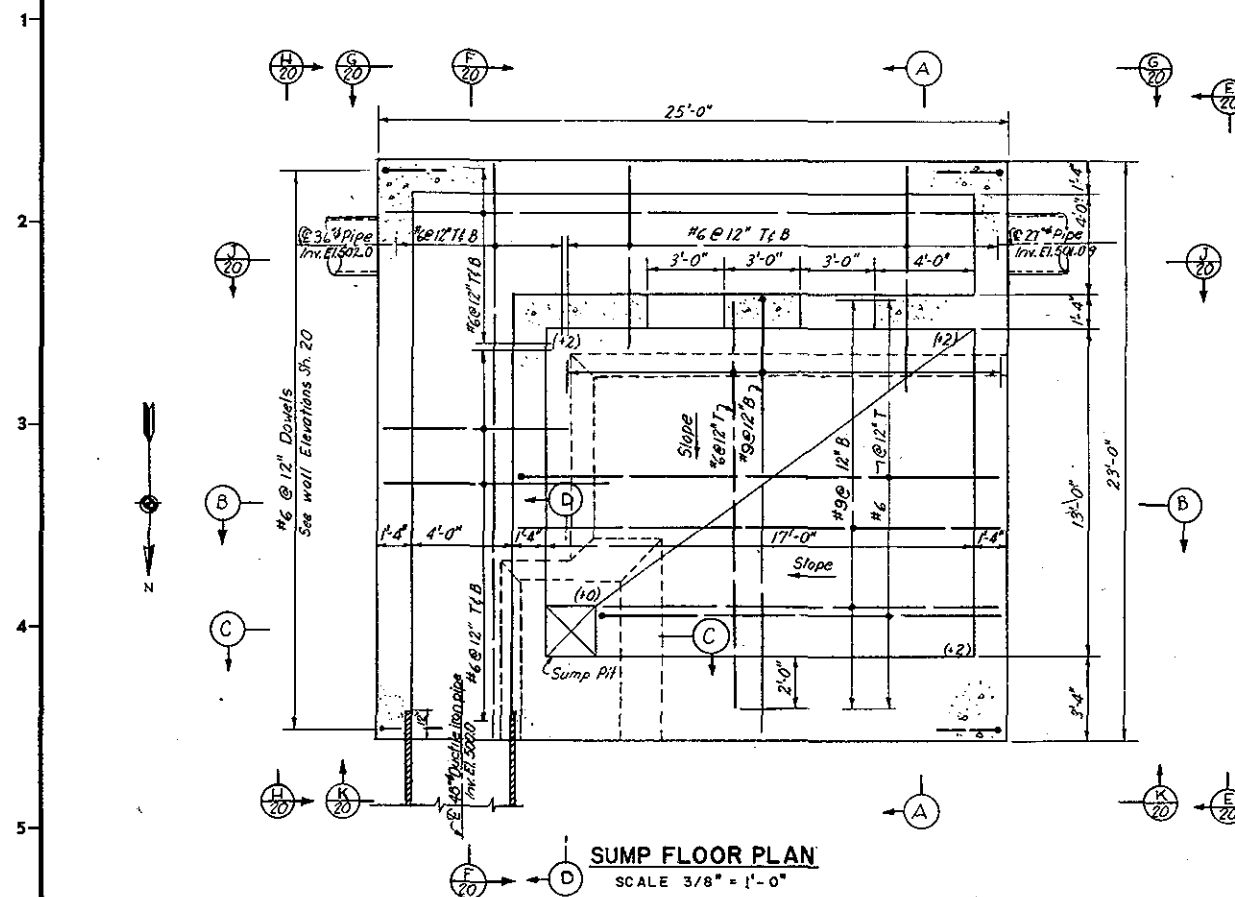
### GRAPHIC SCALES



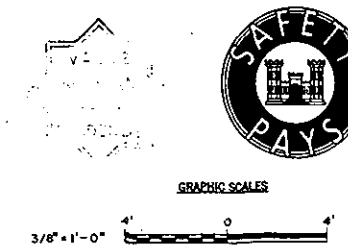
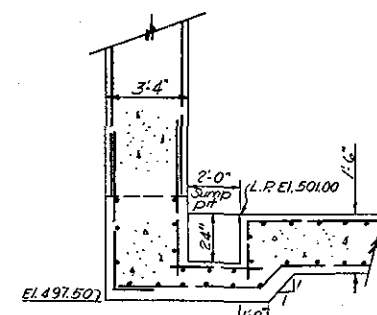
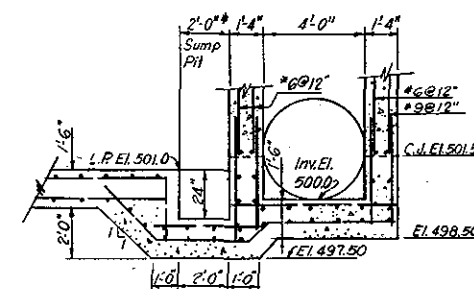
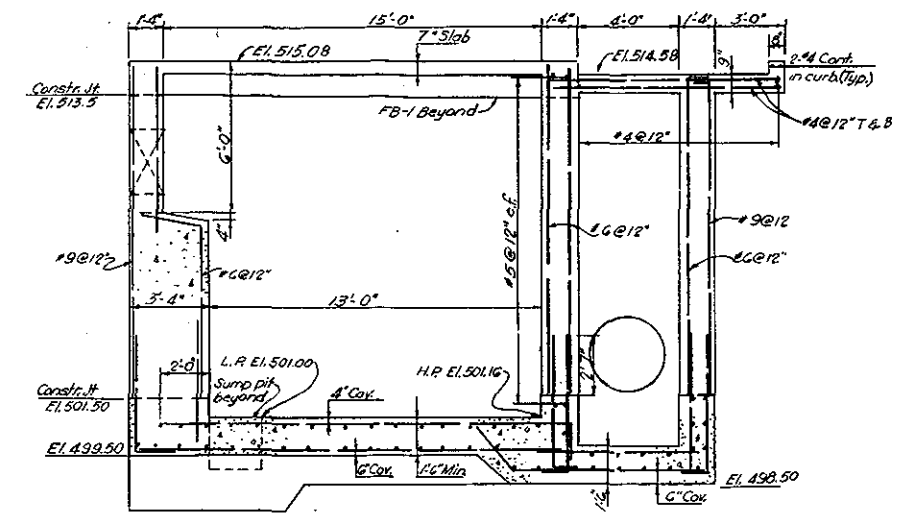
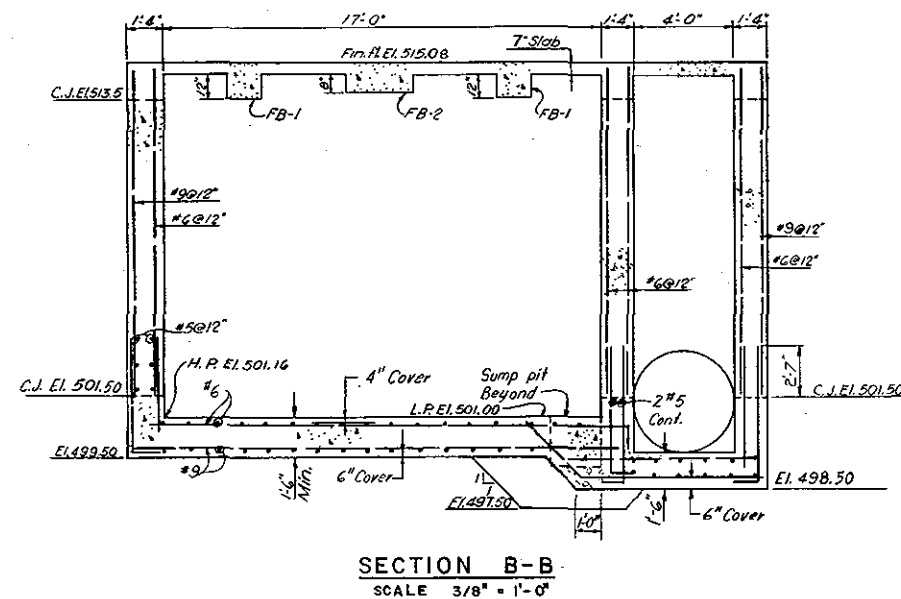
## As Built Drawing

Contract No. DAW-2761-0089

[illegible]



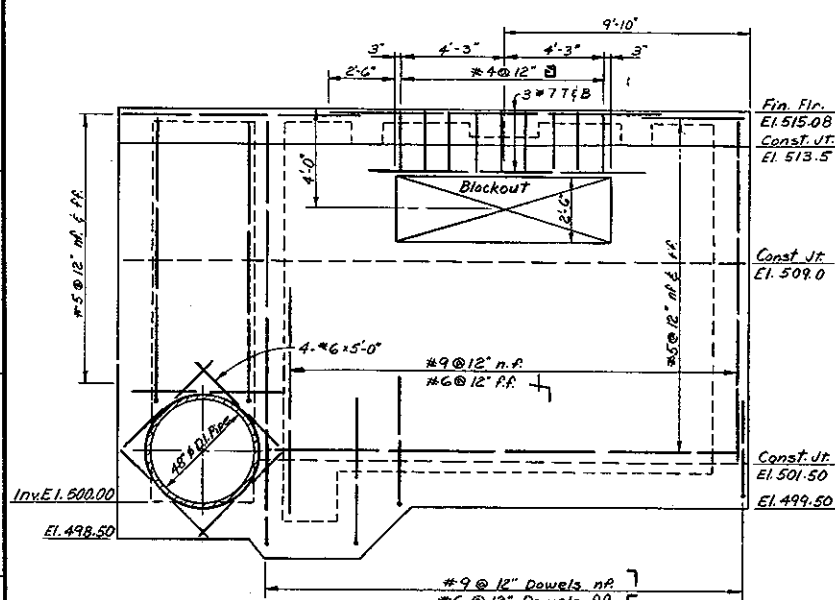
NOTE:  
EL. 501.00 CALLED (+0)



**As Built Drawing**

Contract No. DA-W-276-0089

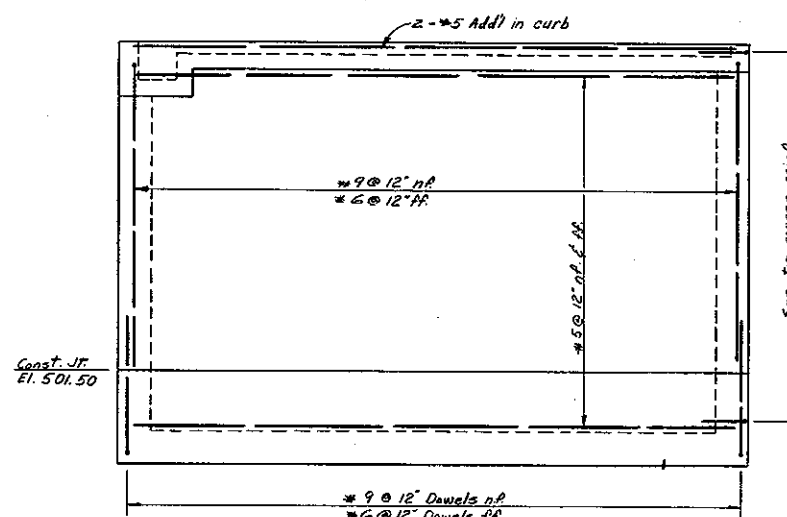
11-13-78 Final field corrections		DATE	DESCRIPTION	BY
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.				
WATER RESOURCES DEVELOPMENT PROJECT FORT KENT, MAINE <b>LOCAL PROTECTION PROJECT</b> PUMPING STATION REINFORCEMENT DETAILS NO. 2 SAINT JOHN RIVER MAINE				
DESIGNED BY W. R. A. Z.	CHIEF ENGINEER J. H. HARRIS	PROJECT ENGINEER J. H. HARRIS	APPROVED J. H. HARRIS	DATE APRIL 1976
SCALE AS SHOWN				SPEC. NO. DACW 33-76-B-0049
DRAWING NUMBER				FOR - 1
SHEET 19				



ELEVATION K

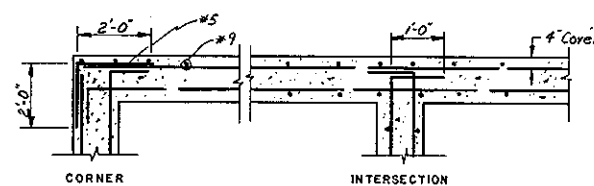
SCALE 3/8" = 1'-0"

NOTE Reinforcing to run thru blackout, steel to be cut as required to install mechanical equipment.



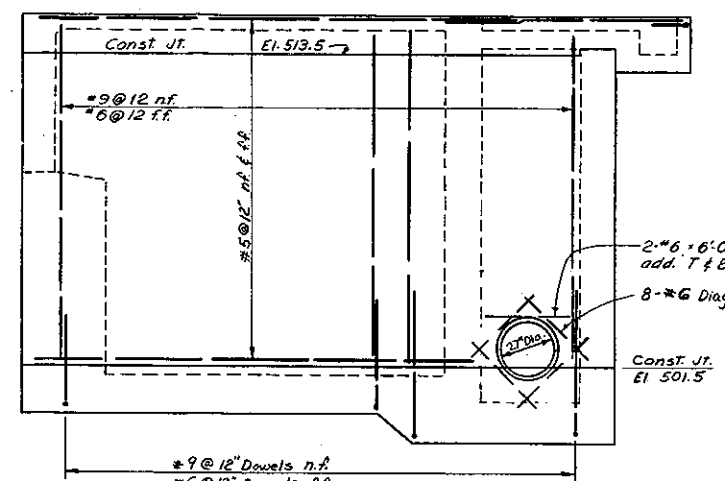
ELEVATION G

SCALE 3/8" = 1'-0"



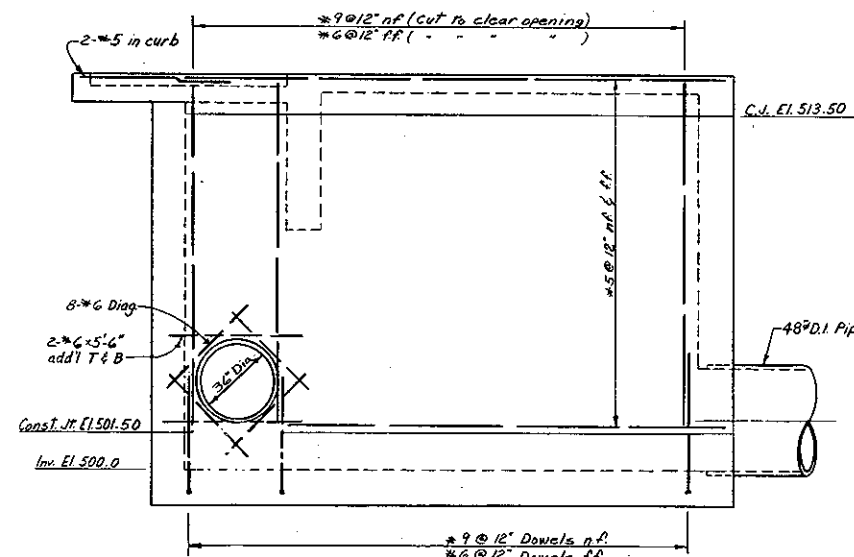
TYPICAL WALL REINFORCING DETAILS

SCALE 1/2" = 1'-0"



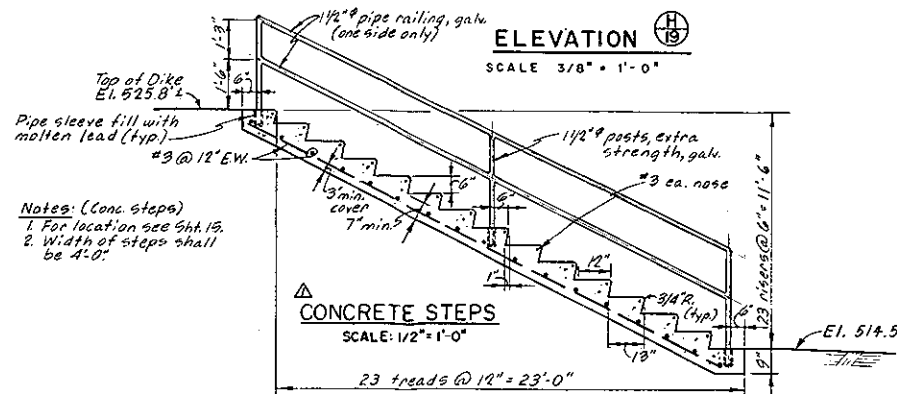
ELEVATION E

SCALE 3/8" = 1'-0"



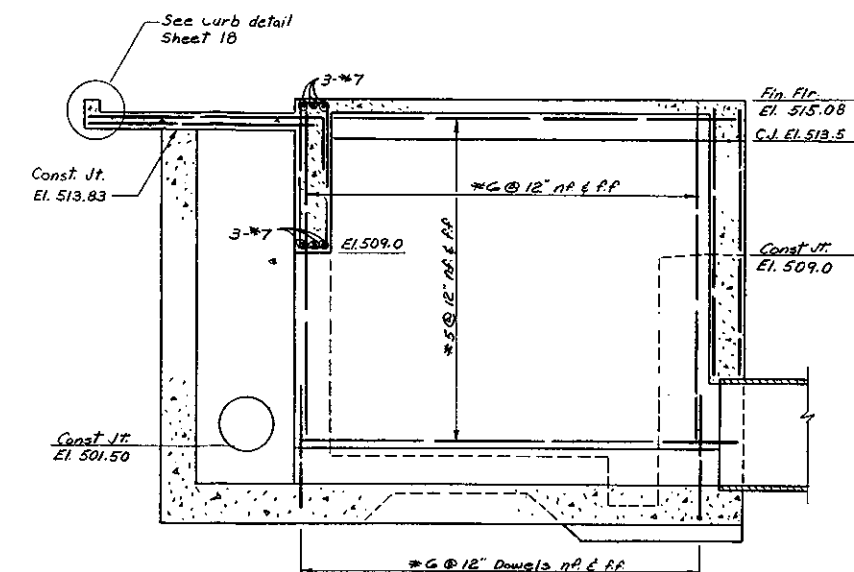
ELEVATION H

SCALE 3/8" = 1'-0"



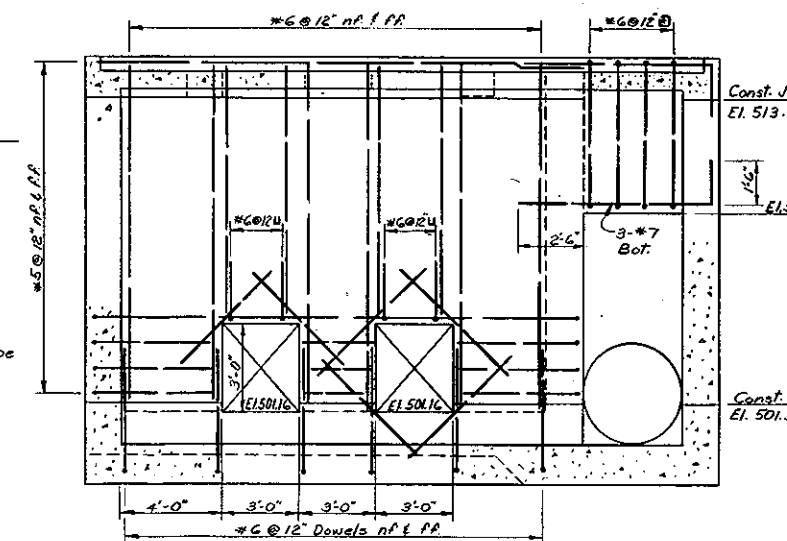
CONCRETE STEPS

SCALE: 1/2" = 1'-0"



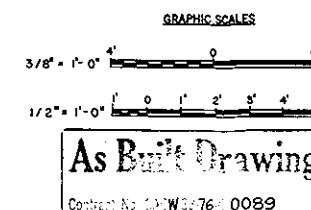
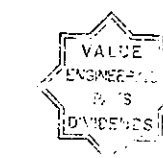
SECTIONAL ELEVATION F

SCALE 3/8" = 1'-0"

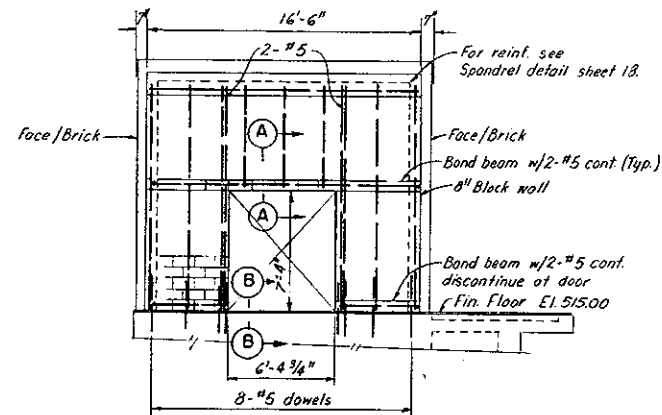


SECTIONAL ELEVATION J

SCALE 3/8" = 1'-0"

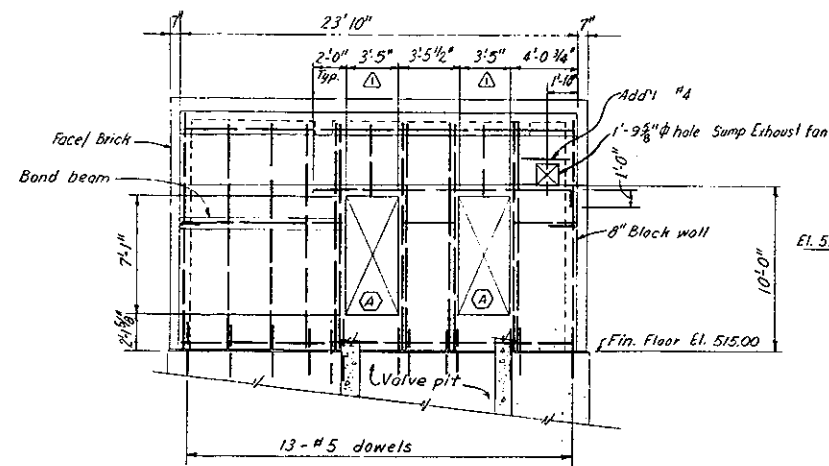


1-13-78 Final field corrections		4-29-76 (conc. steps added (Am. #2))		BY
REVISION	DATE	DESCRIPTION	BY	
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.				
WATER RESOURCES DEVELOPMENT PROJECT FORT KENT, MAINE LOCAL PROTECTION PROJECT PUMPING STATION REINFORCEMENT DETAILS NO. 3				
DES. BY W. R.		CHK. BY K. V.		DATE APRIL 1976
SUBMITTED CIVIL ENGINEERING SECTION		APPROVED MAJOR		SCALE AS SHOWN SPEC. NO. DACW33-76-B-0048 DRAWING NUMBER FOR - 1
SHEET 20				



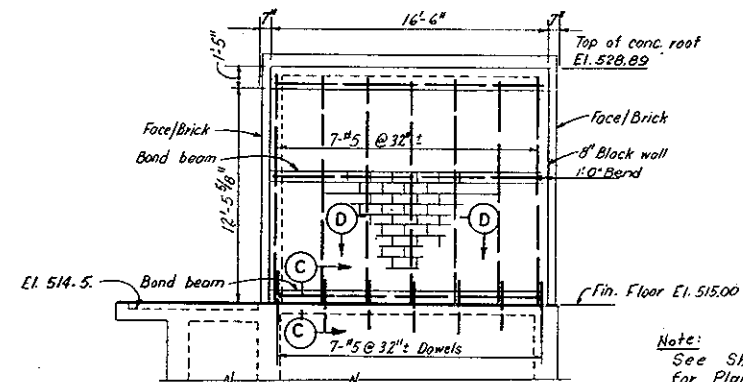
WEST WALL ELEVATION

SCALE 1/4" = 1'-0"



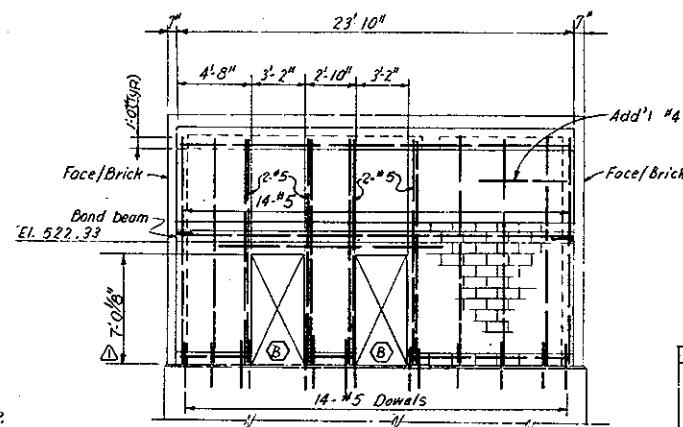
NORTH WALL ELEVATION

SCALE 1/4" = 1'-0"



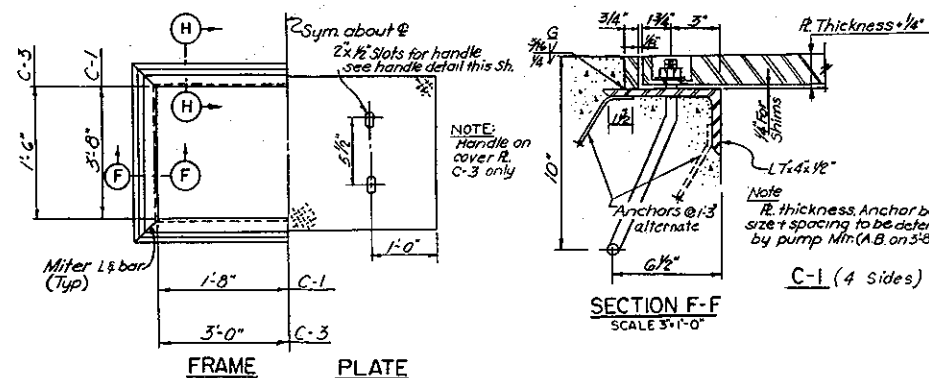
EAST WALL ELEVATION

SCALE 1/4" = 1'-0"



SOUTH WALL ELEVATION

SCALE 1/4" = 1'-0"

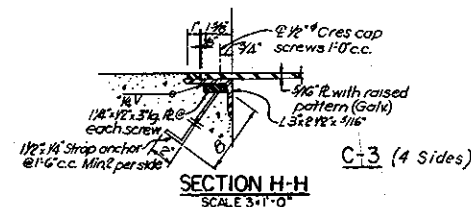


FRAME

PLATE

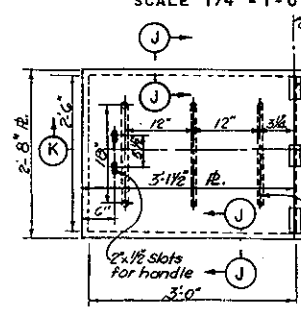
SECTION F-F

SCALE 3/4" = 1'-0"



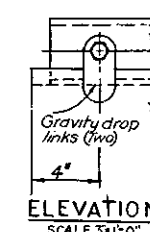
SECTION H-H

SCALE 3/4" = 1'-0"



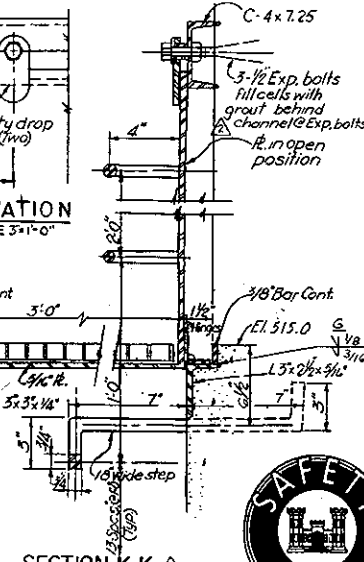
PLAN COVER C-4

SCALE 1/4" = 1'-0"



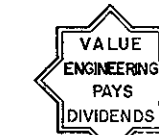
ELEVATION

SCALE 3/4" = 1'-0"



SECTION K-K

SCALE 3/4" = 1'-0"



NOTE: All embedded structural steel plates and shapes shall be hot-dip galvanized after fabrication.

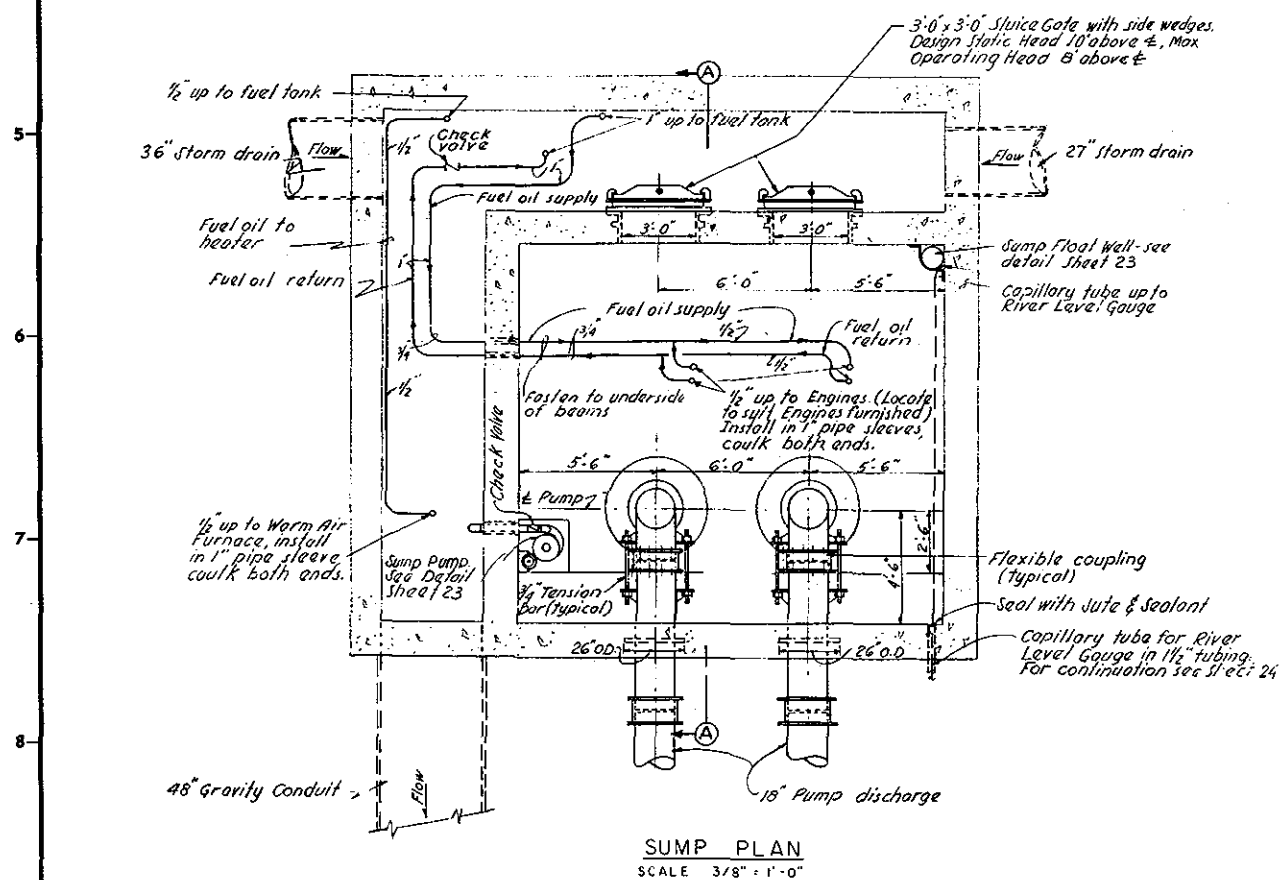
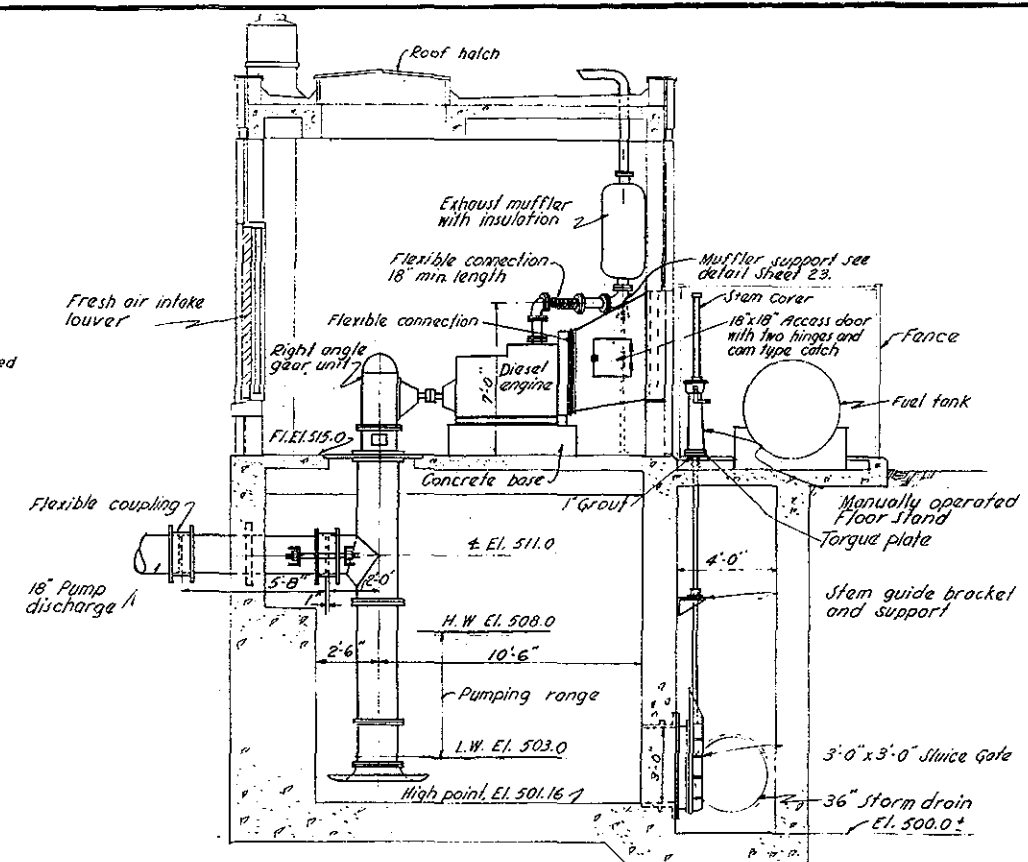
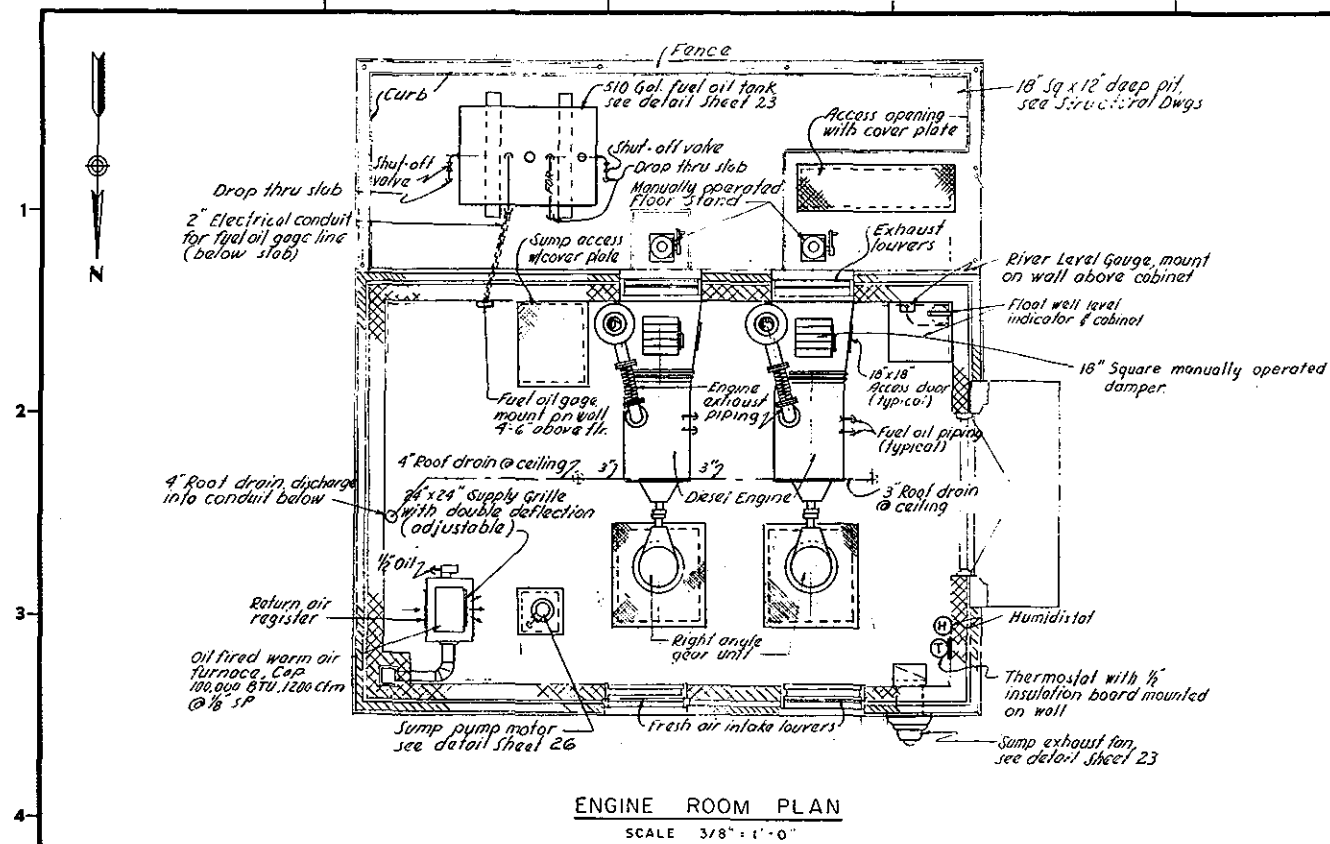
REVISION	DATE	DESCRIPTION	BY
1-13-78	Final field corrections		
12-17-74	Deleted concrete notes, added grout (mortar) notes, and revised		
4-29-76	Dimen's changed Plans & Sections revised (Am#2)		

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT  
FORT KENT, MAINE  
LOCAL PROTECTION PROJECT  
PUMPING STATION  
STRUCTURAL - MASONRY WALL DETAILS  
SAINT JOHN RIVER  
MAINE

APPROVED: [Signature]  
DATE: APRIL 1978  
SCALE AS SHOWN SPEC. NO. DACW33-78-B-0048  
DRAWING NUMBER  
FOR - I

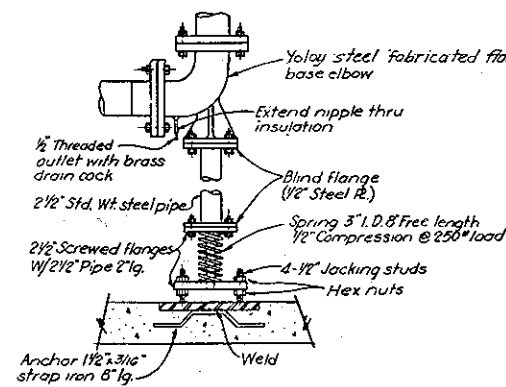
SHEET 21



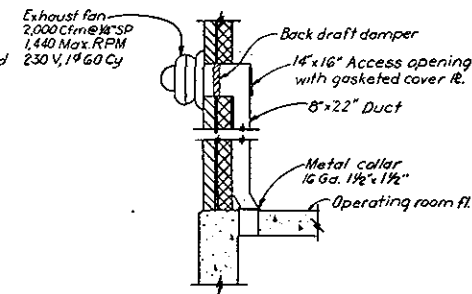
As Built Drawing

CORP. DRAWING 76 0089

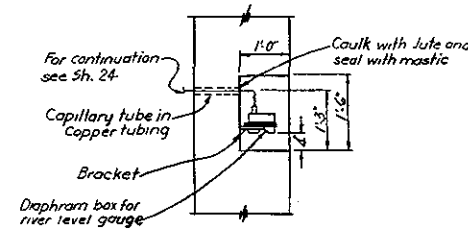
1-13-78 Final field corrections		BY
REVISION	DATE	DESCRIPTION
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.		
WATER RESOURCES DEVELOPMENT PROJECT FORT KENT, MAINE LOCAL PROTECTION PROJECT PUMPING STATION MECHANICAL PLANS, SECTIONS AND DETAILS SAINT JOHN RIVER MAINE		
DES. BY J.S. CHECKED BY J.V. APPROVED BY J.V.	DATE APRIL 1976	SPEC. NO. DACW33-76-8-0046 DRAWING NUMBER FOR - I



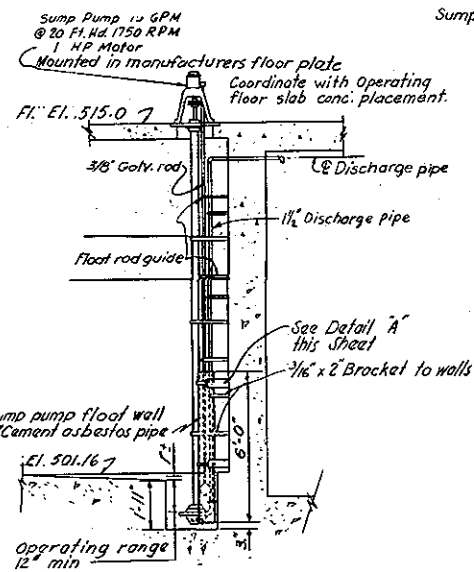
DETAIL MUFFLER SUPPORT  
NOT TO SCALE



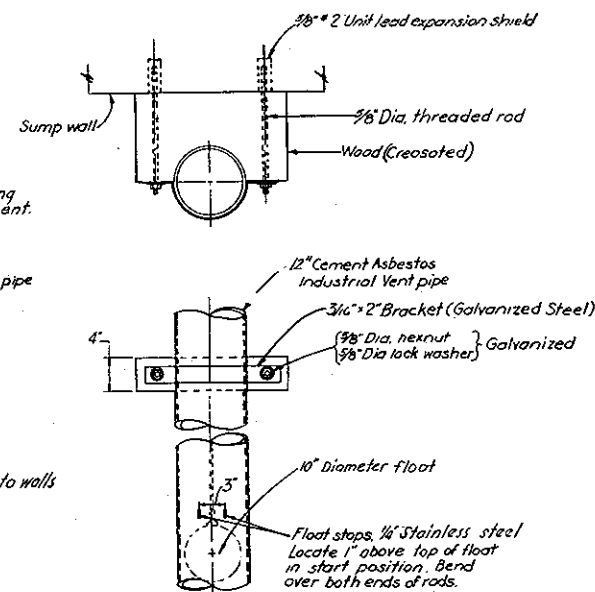
DETAIL EXHAUST FAN  
SCALE 3/8" = 1'-0"



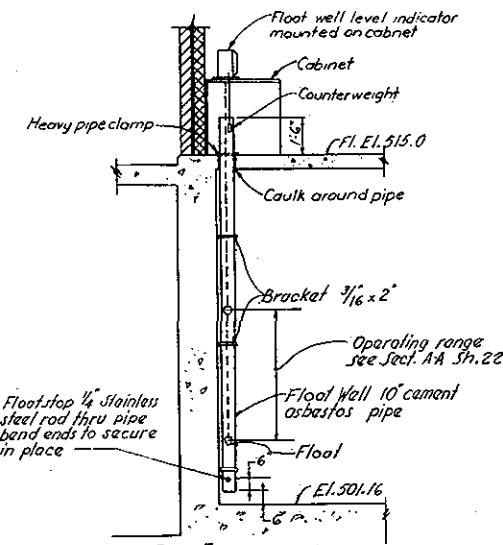
DETAIL RIVER LEVEL GAUGE  
SCALE 3/4" = 1'-0"



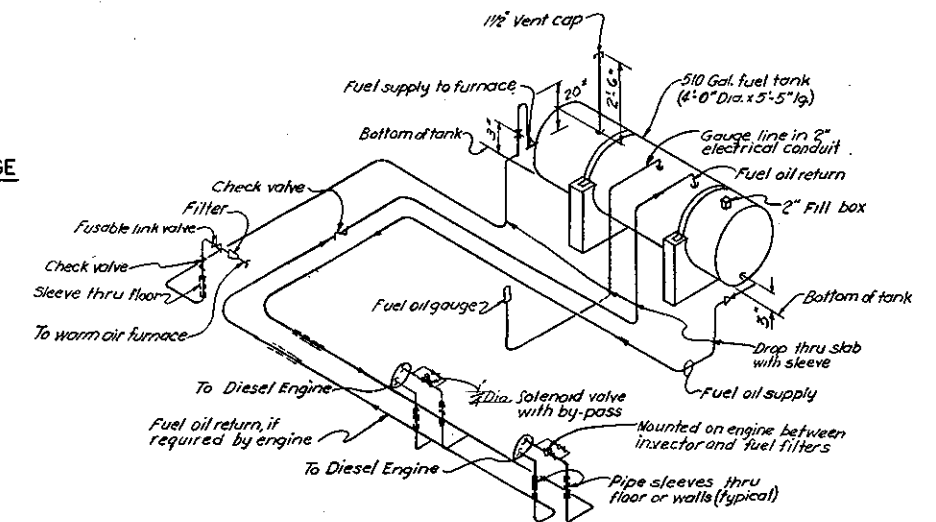
DETAIL SUMP PUMP  
SCALE 3/8" = 1'-0"



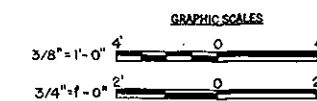
DETAIL "A"  
NOT TO SCALE



DETAIL SUMP FLOAT WELL  
SCALE 3/8" = 1'-0"



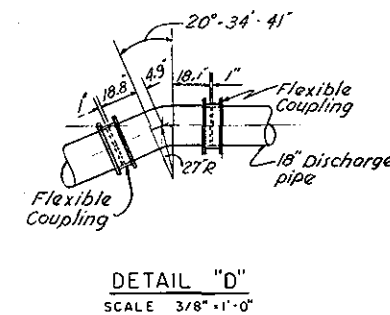
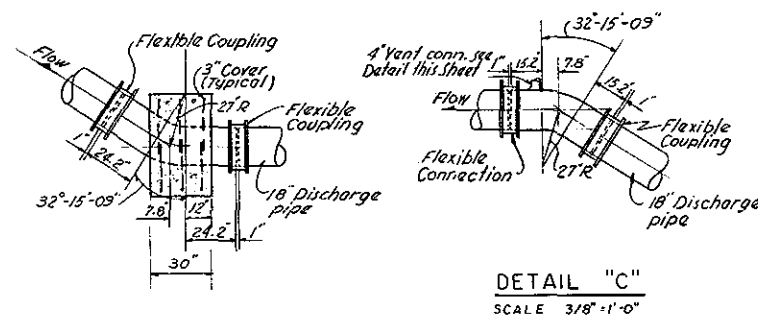
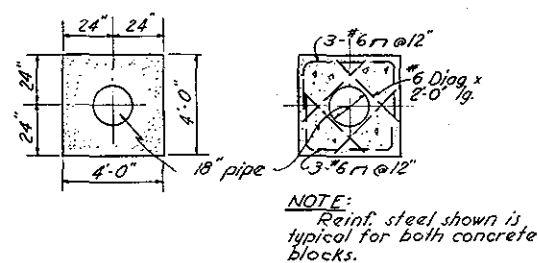
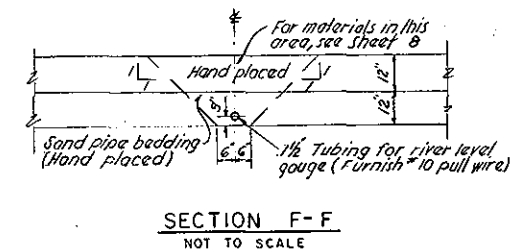
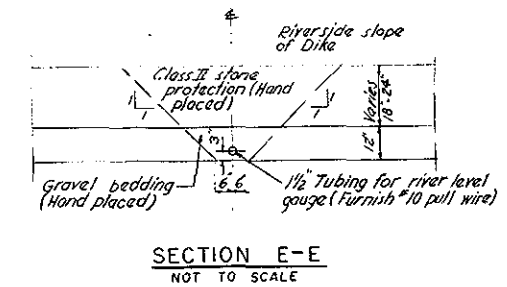
DETAIL FUEL OIL PIPING  
NOT TO SCALE



**As Built Drawing**

Contract No. DACW3376 C 0089

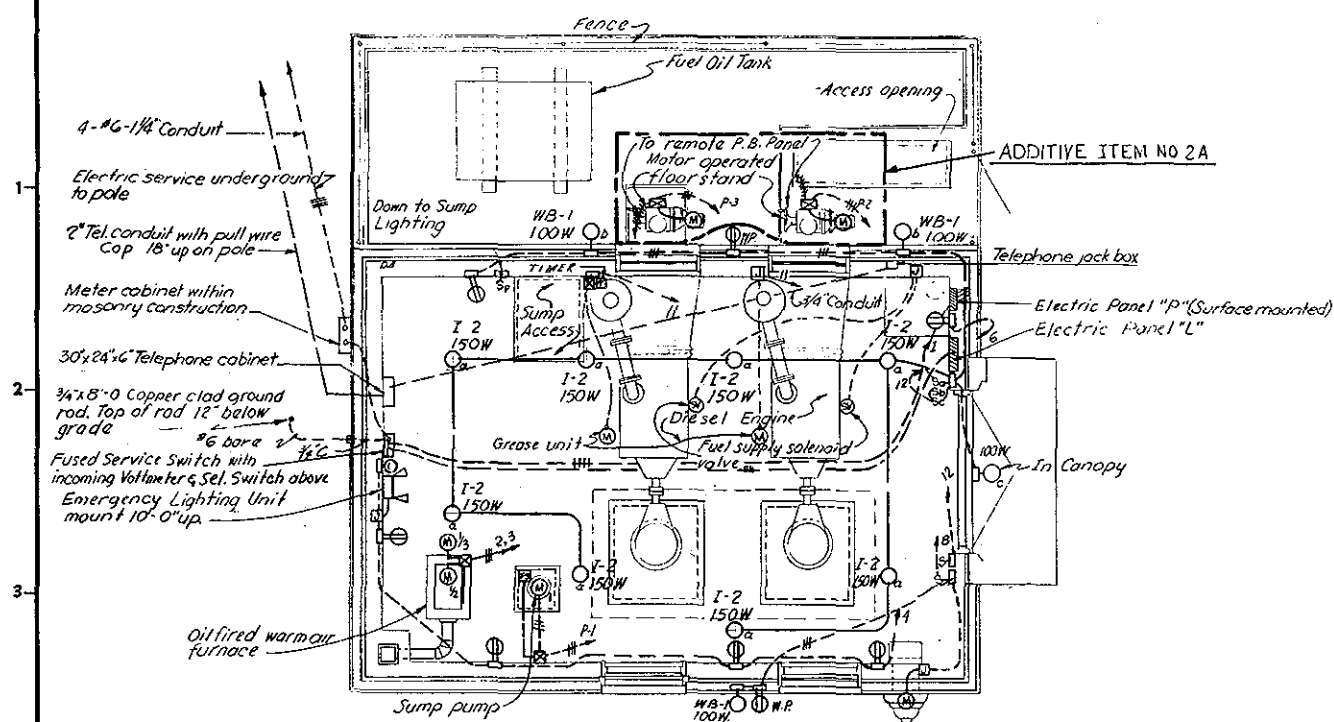
REVISION		DATE	DESCRIPTION	BY
1-13-78			Final field corrections	
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.				
DES. BY J.V. DRAWN BY A.Z. CHECKED BY S.Y.S. PROJECT ENGINEER PROJECT DESIGNER PROJECT MANAGER	WATER RESOURCES DEVELOPMENT PROJECT FORT KENT, MAINE <b>LOCAL PROTECTION PROJECT</b> PUMPING STATION MECHANICAL SAINT JOHN RIVER MAINE DATE APRIL 1976			
SCALE AS SHOWN SPEC. NO. DACW33-76-B-0046 DRAWING NUMBER FOR - I		SHEET 23		

[illegible]

### As Built Drawings

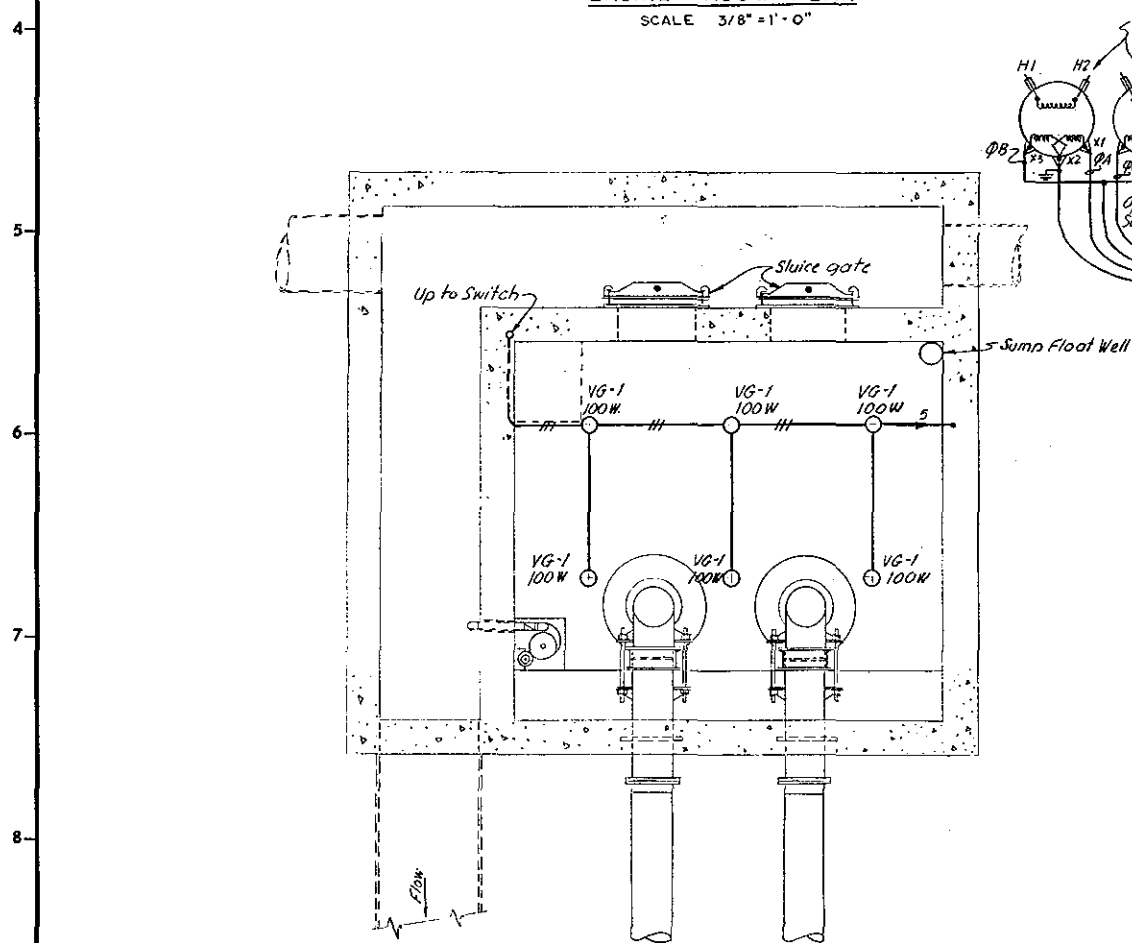
104-10600W 76 0089





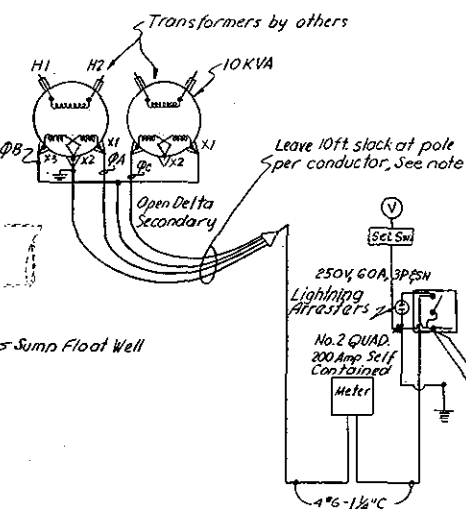
ENGINE ROOM PLAN

SCALE 3/8" = 1'-0"



SUMP PLAN

SCALE 3/8" = 1'-0"



ONE LINE DIAGRAM

NOT TO SCALE

PANEL "L"				
120/240V		50AMP	1P MAIN BREAKER	3 WIRE
CIRCUIT NUMBER	BREAKER SIZE AMPS	NUMBER OF POLES	SERVES	CONNECTED LOAD KVA
1	20	1	Lighting	1.2
2	20	1	Fan	1/3
3	20	1	Furnace	1/3
4	20	1	Receptacles	1.0
5	20	1	Sump lighting	.6
6	20	1	Float Well recept. & sol. valves	.2
7	20	1	Spare	—
8	20	1	Sump exhaust fan	1/3
9	20	1	Battery charger	.1
10	20	1	Spare	—
11	20	1	Grease Unit	1/3
12	20	1	Exterior lighting & Recept.	.6
13	20	1	Spare	—
14	20	1	Spare	—

PANEL "P"				
240V. 3P		50AMP MAIN BREAKER	3 WIRE	
CIRCUIT NO.	BKR. SIZE AMPS	NO. OF POLES	SERVES	CONN. LOAD KVA
1	15	3	Sump Pump	1
2	15	3	Spare	—
3	15	3	Spare	—
4	20	3	Spare	—
5	15	3	Spare	—
6	20	3	Spare	—

FIXTURE SCHEDULE				
TYPE	LAMP WATTS	DWG. NO.	SH.	REMARKS
VG-1	100W	40-06-04	10	
I-2	150W	40-06-04	3	
WB-1	100W	40-06-04	30A	
C	100W	—	—	ITT ART METAL CAT. NO. VB5C

LEGEND	
SYMBOL	DESCRIPTION
○	Ceiling outlet
○	Wall outlet
⊕	Junction box
⊕	Duplex convenience outlet - WP indicates weather proof
⊕	Motor - 1P as indicated
⊕	Emergency lighting unit
⊕	Panel
⊕	Controller
⊕	Telephone outlet, 1'-0" up
—	Branch circuit concealed in ceiling or wall
—	Branch circuit in floor
—	Home run to panelboard. Note: Any circuit without further designation indicates a two-wire circuit. For a greater number of wires indicate as follows: — (3 wires) — (4 wires) etc.
S	Single pole switch, 4'-0" up
FS	Float switch
⊕	Clock Outlet
V	Voltmeter
SEL SW	Selector Switch
SV	Solenoid Valve

## NOTE:

1. Panel board "P" will be supplied with 240 volt, single phase current. The wiring from the pole weatherhead to the distribution panel boards shall be installed as detailed on the drawings, except that the extra #6 wire at Panel "P" and the weatherhead will be coiled and taped for future use when three (3) phase current is installed. All circuits of Panel "P" shall be provided with (3) pole breakers as indicated on the drawings. Circuit No. P-1 shall be wired for operation of the sump pump using two (2) poles of the three (3) pole breaker.

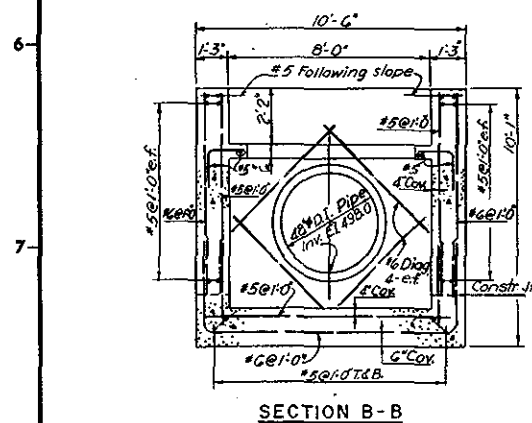
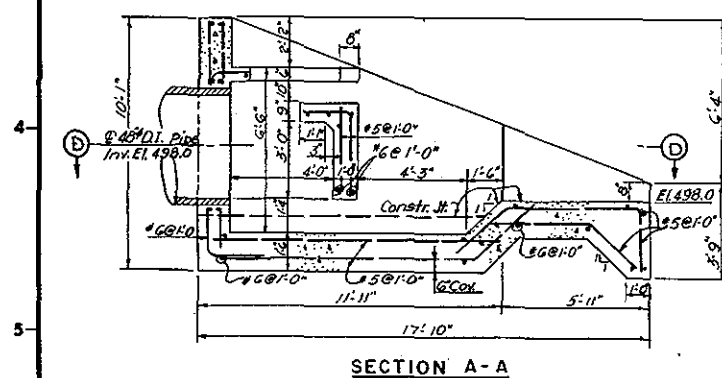
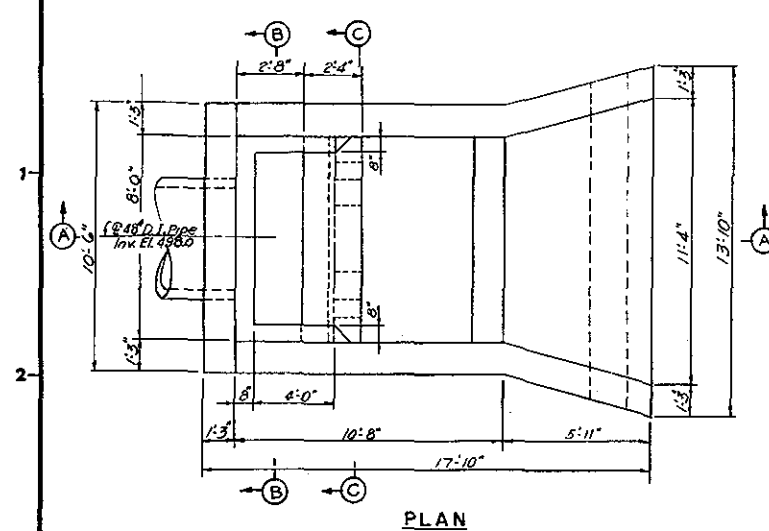
Note:  
Connect 1P Panel to Transf. #A and #B and Neutral on Open Delta Connection



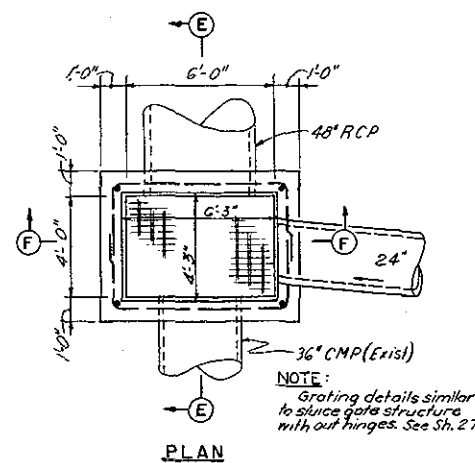
GRAPHIC SCALES  
3/8" = 1'-0"

As Built Drawing  
76 0089

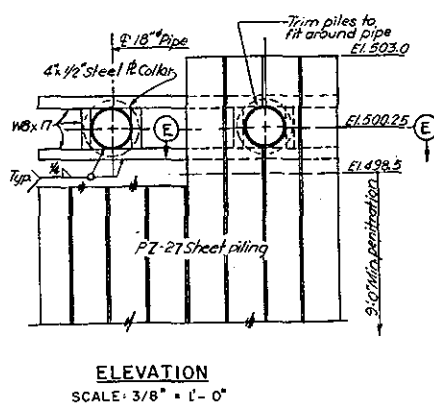
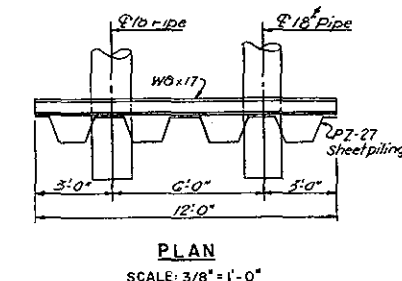
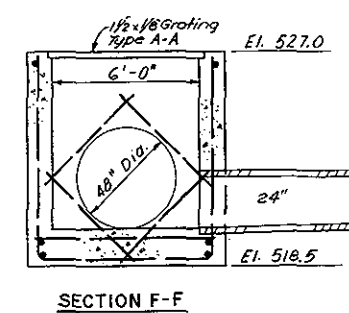
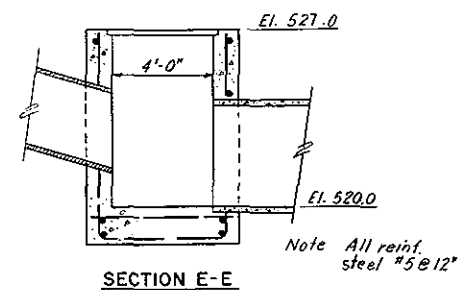
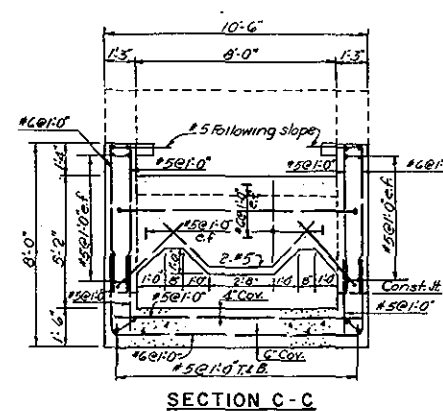
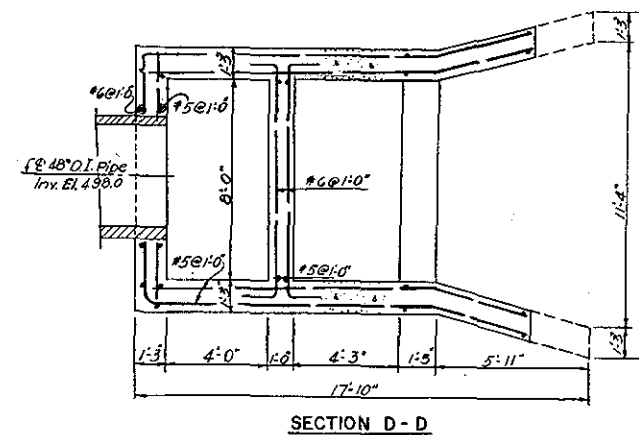
1-13-78 Final field corrections		DATE	DESCRIPTION	BY
DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.				
WATER RESOURCES DEVELOPMENT PROJECT FORT KENT, MAINE LOCAL PROTECTION PROJECT PUMPING STATION ELECTRICAL PLANS, DIAGRAM, AND SCHEDULE SAINT JOHN RIVER MAINE				
DES. BY L. F.	CHK. BY J. D.	DATE APRIL 1976	APPROVED DATE	
SCALE AS SHOWN SPEC. NO. DACW 53-76-B-0048		DRAWING NUMBER FOR - 1		



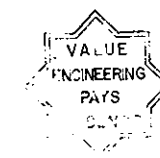
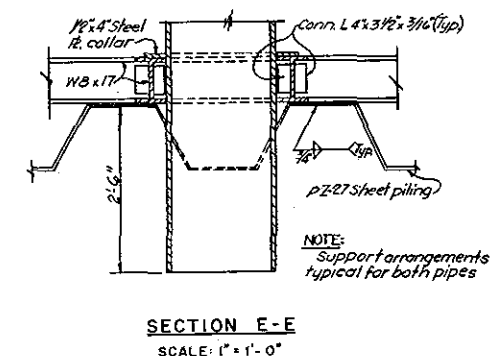
OUTLET STRUCTURE - 48" PRESSURE CONDUIT  
SCALE 3/8" = 1'-0"



SPECIAL DRAINAGE INLET  
SCALE 3/8" = 1'-0"



DISCHARGE PIPES - HEADWALL  
SCALE 3/8" = 1'-0"



GRAPHIC SCALES  
1/4" = 1'-0"  
3/8" = 1'-0"

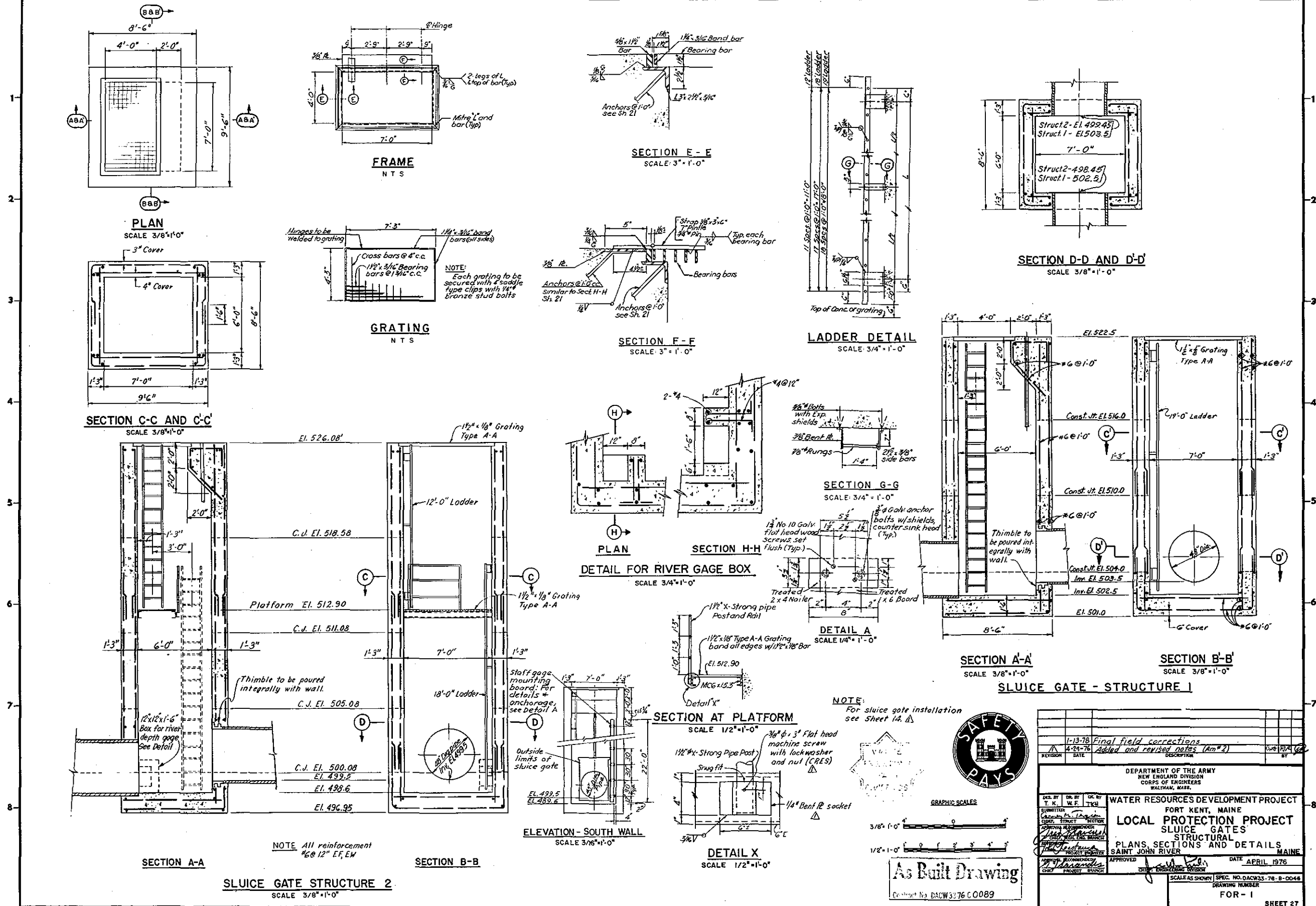
As Built  
NEW 0089

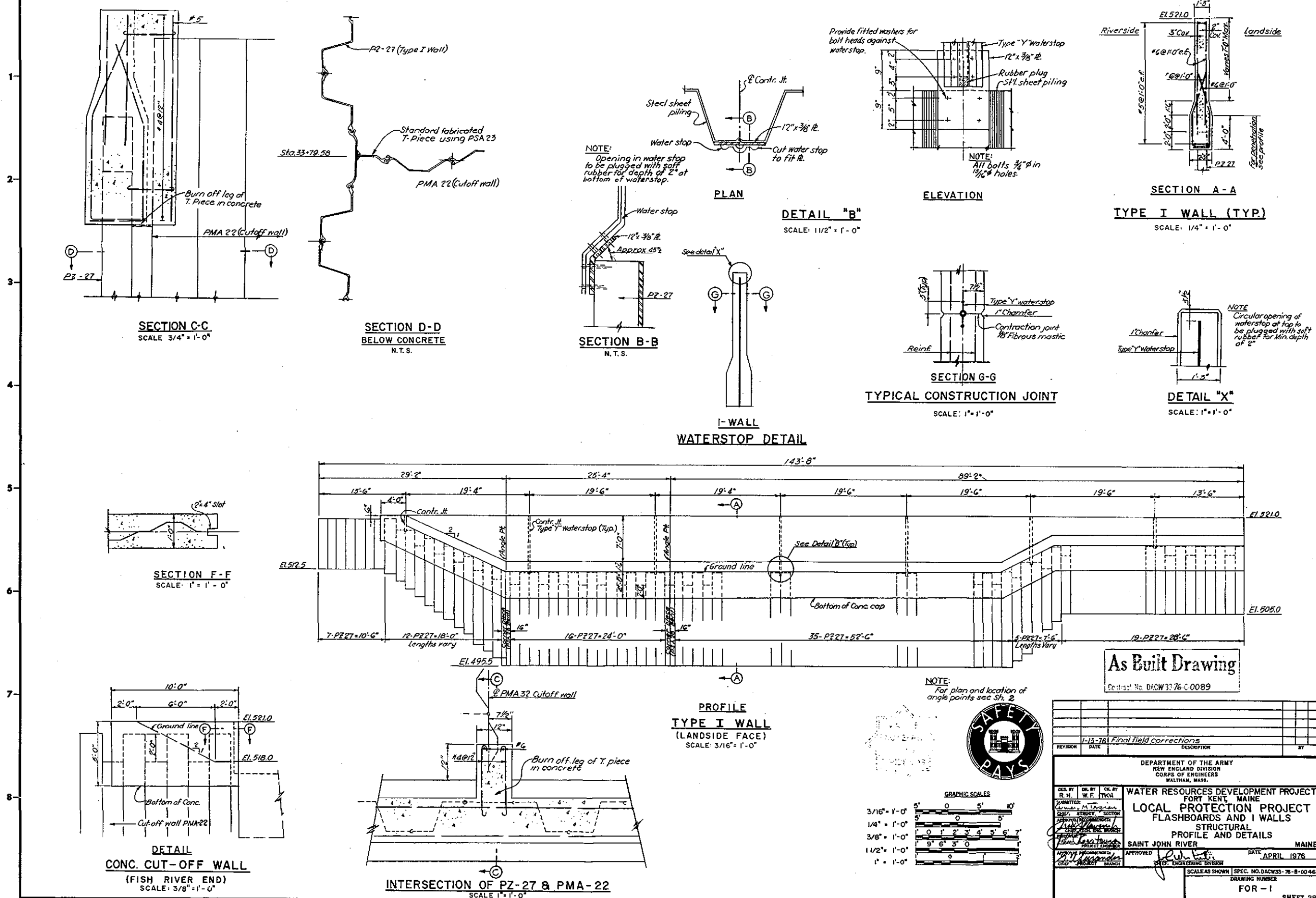
REVISION	DATE	DESCRIPTION	BY

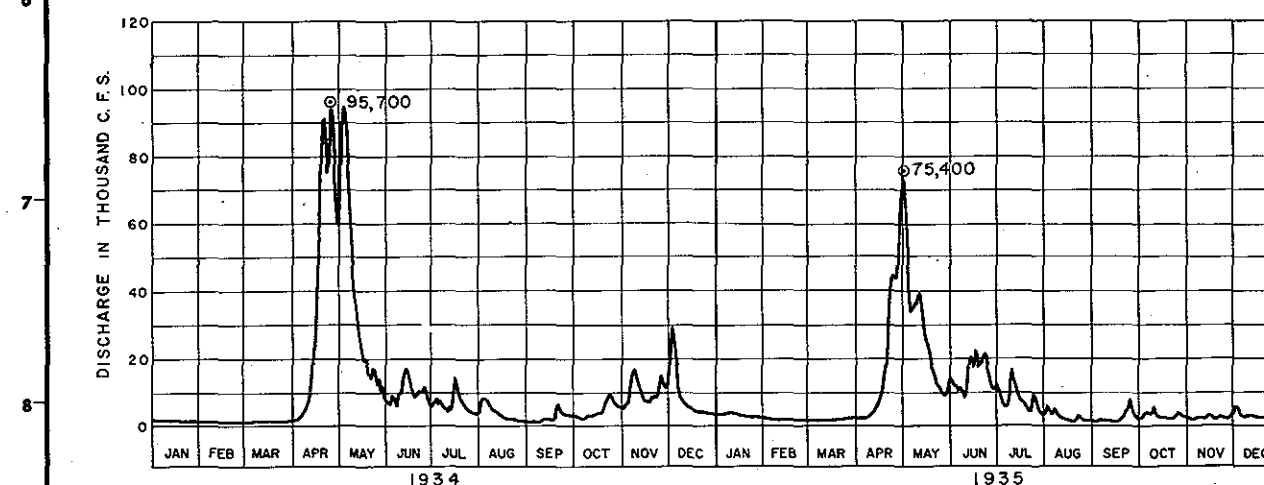
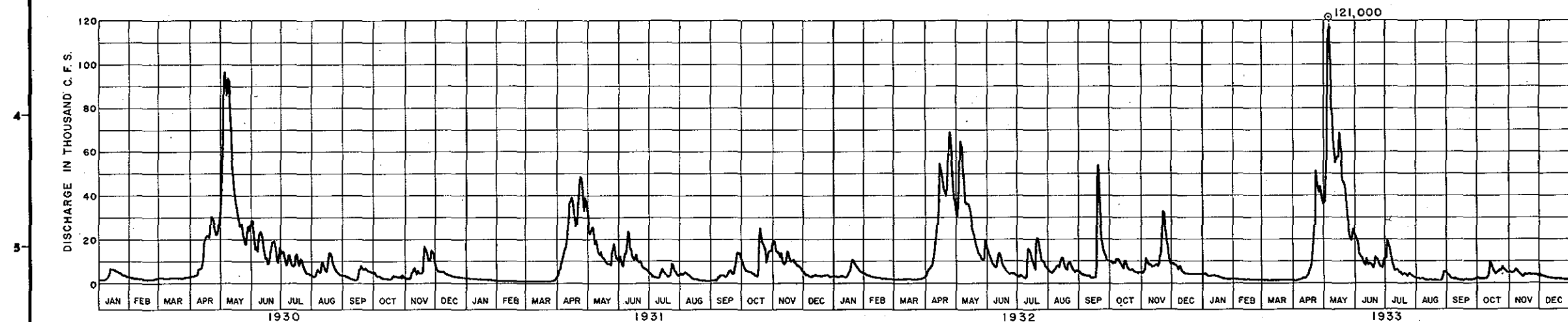
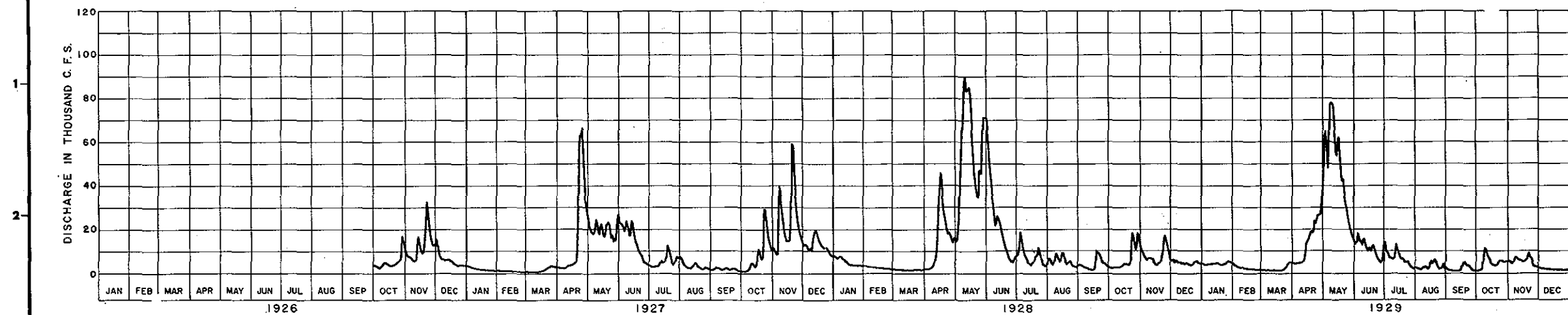
DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTRAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT  
FORT KENT, MAINE  
LOCAL PROTECTION PROJECT  
OUTLET STRUCTURE AND HEADWALL  
STRUCTURAL  
PLANS AND SECTIONS  
SAINT JOHN RIVER MAINE

DATE: APRIL 1976  
APPROVED: [Signature]  
SCALE AS SHOWN SPEC. NO. DACW33-76-B-0048  
DRAWING NUMBER  
FOR - 1 SHEET 26







## GENERAL NOTES:

THESE HYDROGRAPHS ARE THE DAILY AVERAGE STREAM FLOW RECORDS OF THE ST. JOHN RIVER AT FORT KENT, MAINE FROM THE TRIBUTARY DRAINAGE AREA OF 5690 SQUARE MILES.

INSTANTANEOUS DISCHARGES, WHERE AVAILABLE, ARE SHOWN BY @.

THE DATA CONTAINED HEREON ARE NOT INTENDED AS REPRESENTATIONS OR WARRANTIES BUT ARE FURNISHED AS INFORMATION ONLY. IT IS EXPRESSLY UNDERSTOOD THAT THE GOVERNMENT WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION OR CONCLUSION THEREFROM MADE BY ANY BIDDER OR CONTRACTOR.

FOR RATING CURVE SEE HYDROGRAPH NO. 5, SHEET 33



GRAPHIC SCALES

As Built Drawing

Contract No. DACW3376-C-0089

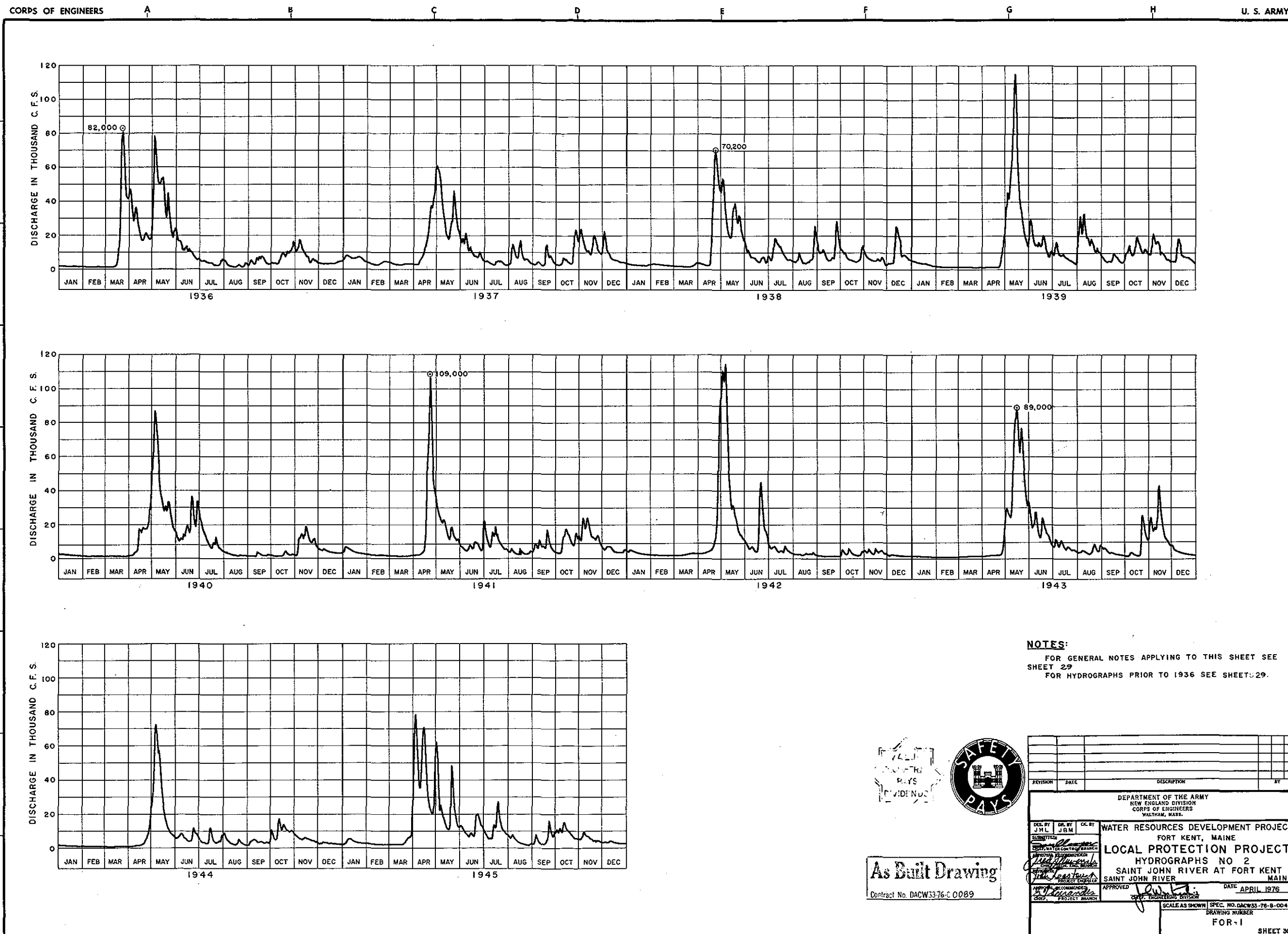
REVISION	DATE	DESCRIPTION	BY

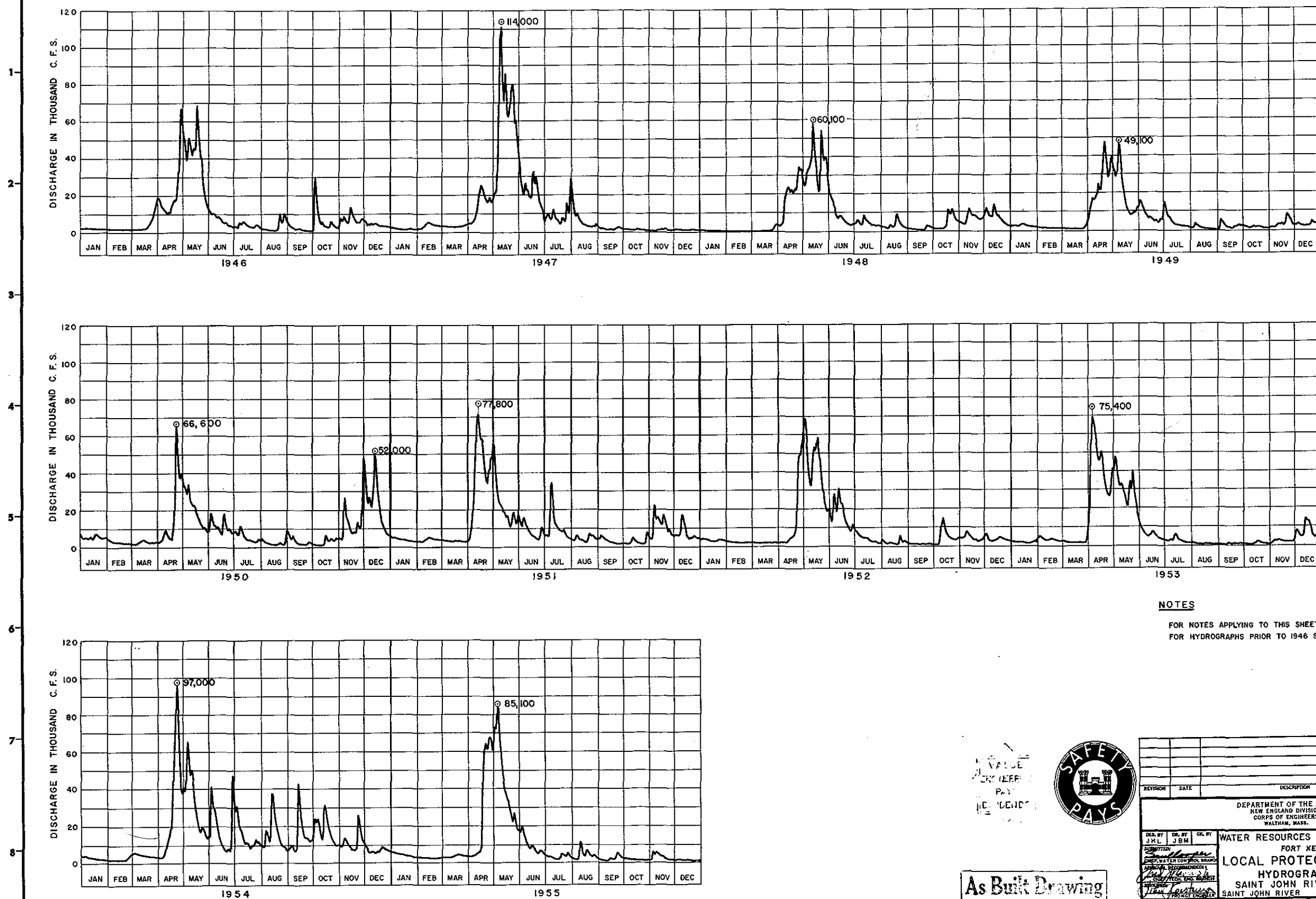
DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT  
FORT KENT, MAINE  
LOCAL PROTECTION PROJECT  
HYDROGRAPHS NO. 1  
SAINT JOHN RIVER AT FORT KENT  
SAINT JOHN RIVER MAINE

APPROVED: *[Signature]* DATE: APRIL 1976  
SCALE AS SHOWN SPEC. NO. DACW33-76-B-0048  
DRAWING NUMBER  
FOR-1

SHEET 29





## NOTES

FOR NOTES APPLYING TO THIS SHEET SEE SHEET 29  
FOR HYDROGRAPHS PRIOR TO 1946 SEE SHEETS 29 & 30

NO VALUE  
FOR DEEP  
PAY  
DEPENDENT



As Built Drawing

Contract No. DACW33-76-1-0089

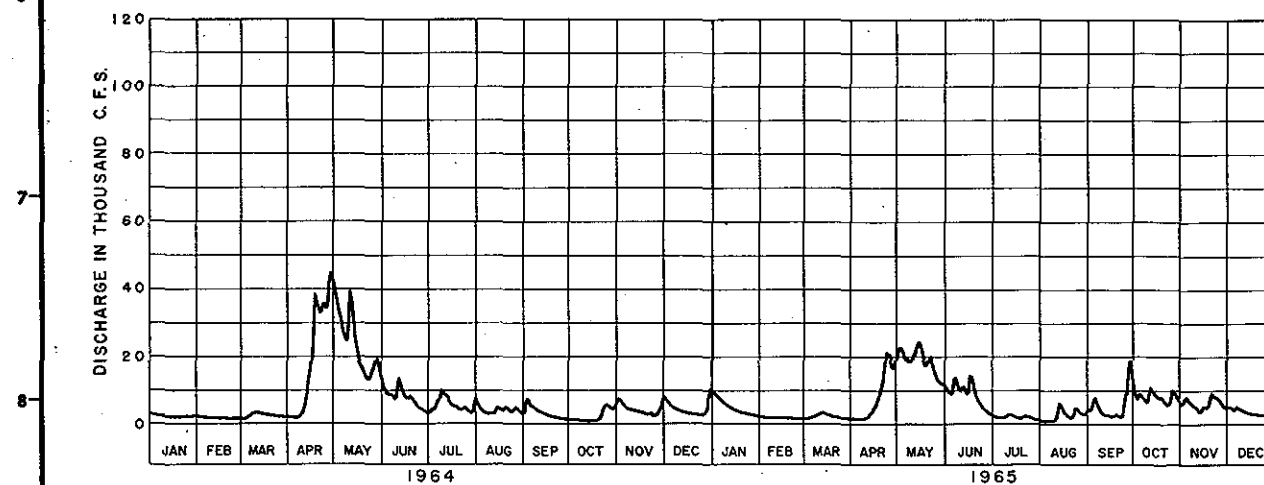
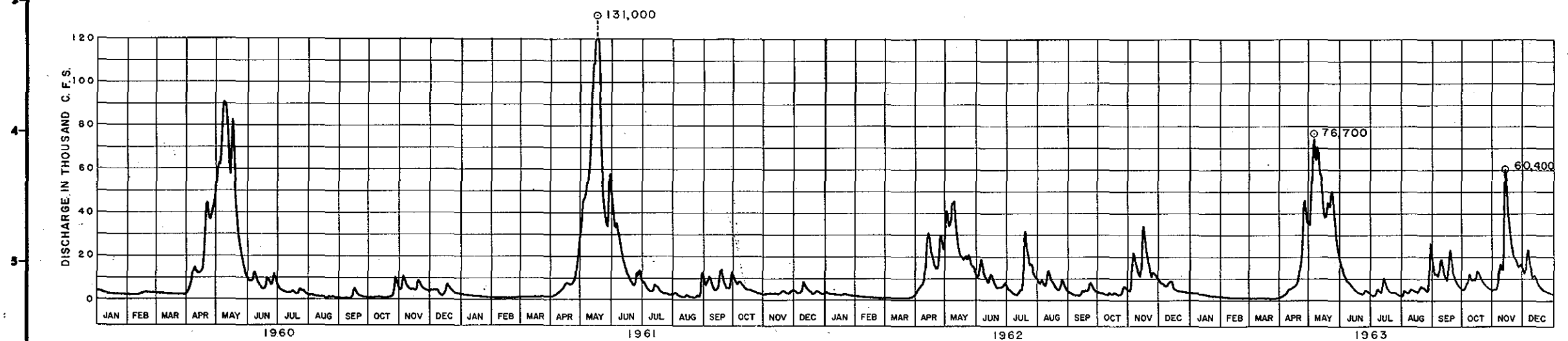
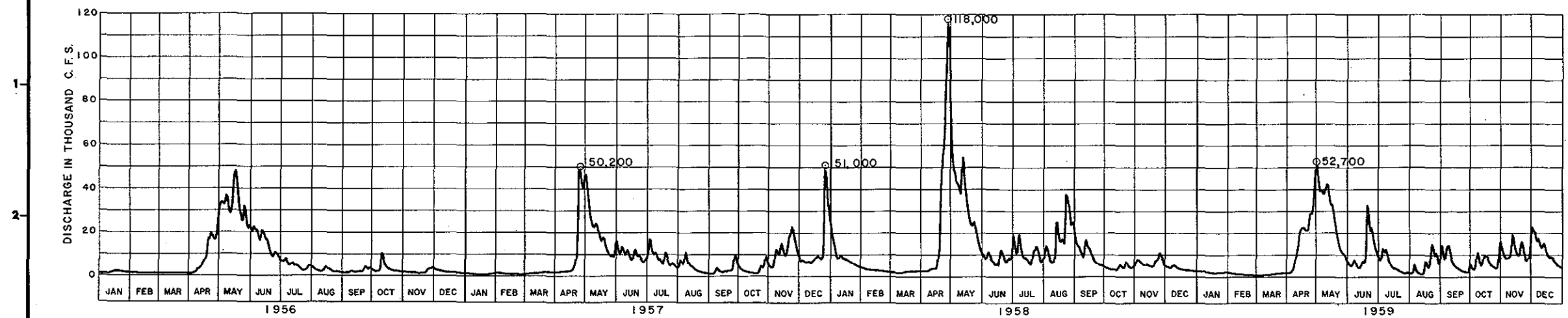
REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTHAM, MASS.

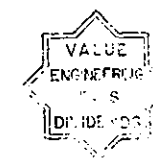
WATER RESOURCES DEVELOPMENT PROJECT  
FORT KENT, MAINE  
LOCAL PROTECTION PROJECT  
HYDROGRAPHS NO. 3  
SAINT JOHN RIVER AT FORT KENT  
SAINT JOHN RIVER MAINE

DATE: APRIL 1976

SCALE AS SHOWN SPEC. NO. DACW33-76-1-0046  
DRAWING NUMBER  
FOR-1  
SHEET 31



NOTES:  
FOR GENERAL NOTES APPLYING TO THIS SHEET SEE  
SHEET 29  
FOR HYDROGRAPHS PRIOR TO 1956 SEE SHEETS 29-31



As Built Drawing

Contract No. DACW33-76-C-0089

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WALTHAM, MASS.

DES. BY: JML  
CHK. BY: JBM  
SUBMITTED:  

CHIEF, WATER CONTROL BRANCH  
ENGINEER, HYDROGRAPHIC BRANCH  
ENGINEER, PROJECT BRANCH

WATER RESOURCES DEVELOPMENT PROJECT  
FORT KENT, MAINE  
LOCAL PROTECTION PROJECT  
HYDROGRAPHS NO. 4  
SAINT JOHN RIVER AT FORT KENT MAINE

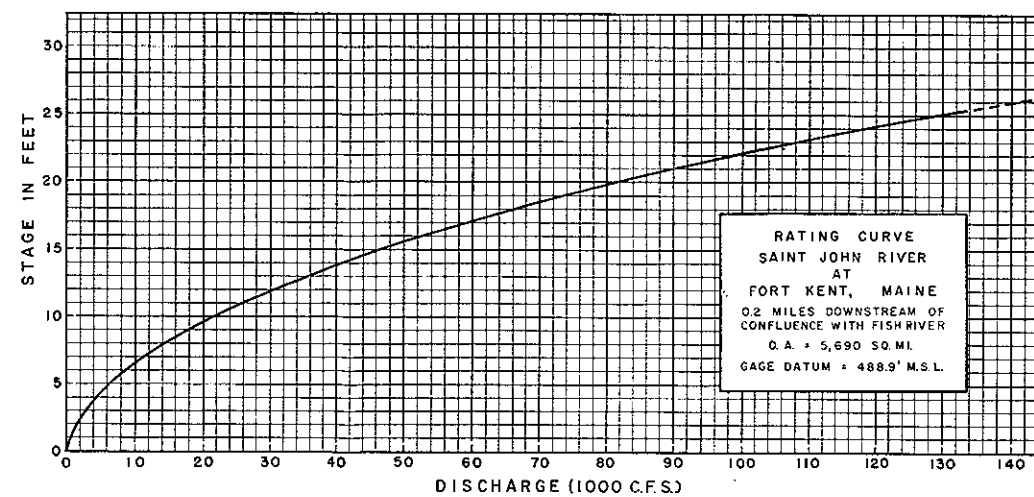
APPROVED:  

DATE: APRIL 1976

SCALE AS SHOWN SPEC. NO. DACW33-76-B-0046  
DRAWING NUMBER  
FOR-1

SHEET 32





Contract No. DACW 33-76-C-0089

[illegible]